

Revision of the Genus *Pandanus* Stickman, Part 14 New Species from Malaya and Singapore

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AS A RESULT of field work in Malaya and Singapore and of study in the herbarium at Singapore, numerous new species of *Pandanus* have been detected. The following novelties are of this origin.

Pandanus attenuatus sp. nov. (sect. *Acrostigma*)

Fig. 150

DIAGNOSIS HOLOTYPI: Frutex probabalter humili, caule in apice 8 mm diametro lutescenti laevi sed cum dorsis longitudinalibus, foliis 35–40 cm longis 18–20.5 mm latis chartaceis supra viridibus infra minime viridibus pallidioribus et proxima basem purpureo-tinctis 1-costatis et minime 2-plicatis subplanis in sectione mediali cum 14–15 nervis parallelis secundariis prominentibus in quoque dimidio nervis tertialis subvisibilis infra proxima apicem, lamina ligulata subito in apice caudato 5.5–6 cm longo 0.7 mm lato contracto basi amplexicauli inermi valde nervosa sed ex 2 cm marginibus cum aculeis 0.5–1.3 mm longis 2–6 mm distantibus subulatis adscendentibus pallidis, midnervo infra ultra mediam inermi, in sectione mediali marginibus cum aculeis 0.7–1 mm longis 1–4 mm distantibus subulatis valde adscendentibus, apice subulato cum marginibus et midnervo infra cum aculeis 0.5–1 mm longis 0.5–1 mm separatis subulatis adscendentibus, inflorescentia foeminea terminali adscendenti cum 1 syncarpio, pedunculo 4.5 cm longo 4 mm diametro trigono bracteato, syncarpio 3.5 cm longo 2.7 cm diametro ellipsoideo cum circa 144 drupis eis 13–13.5 mm longis 4–4.5 mm latis crassisque fusiformibus 5–6-angulosis corpore 6–7 mm longo, pileo 7.5–9 mm longo basi 3.5–4 mm alto ovoideo subanguloso laevi, stylo 4–6 mm longo valde proxime arcuato osseoso subulato olim in basi subanguloso, stigmatate 4–4.5 mm longo late lineari brunneo papilloso in apice extento, endo-

carpio in parte $\frac{1}{3}$ infera lateribus cartilagineis pallidis, seminibus 3.5–4.5 mm longis subdiformatis, mesocarpio apicali hemisphaerico, mesocarpio basali sparso cum fibris fortibus in lateribus.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Shrub, probably low; stem at apex 7–8 mm in diameter, yellowish, smooth but with longitudinal ridges; leaves 35–40 cm long, 18–20.5 mm wide, chartaceous, green above, below slightly paler green and near the base suffused with purple, 1-ribbed, slightly 2-pleated, but nearly flat, at midsection with 14–15 parallel secondary veins in each half, these prominent throughout, cross tertiary veins barely visible only below and near the tip, the blade ligulate, abruptly contracted to a 5.5–7.5 cm caudate tip, this 0.7 mm wide, the base amplexicaul, unarmed, very veiny, beginning 2 cm up the margins with prickles 0.5–1.3 mm long, 2–6 mm apart, subulate, ascending, pale; the midrib below unarmed to beyond the middle; at midsection the margins with prickles 0.7–1 mm long, 1–4 mm apart, subulate, sharply ascending; the subulate apex having the margins and midrib below with prickles 0.5–1 mm long, 0.5–1 mm apart, subulate, ascending; pistillate inflorescence terminal, ascending, bearing 1 syncarp; peduncle 3.5–4.5 cm long, 4 mm in diameter, 3-sided, bracted; syncarp 3–3.5 cm long, 2.7 cm in diameter, ellipsoid, bearing about 120–144 drupes, these 13–13.5 mm long, 4–4.5 mm thick and wide, fusiform, 5–6-angled, the body 6–7 mm long; pileus 7.5–9 mm long, the base 3.5–4 mm high, ovoid, slightly angled, smooth; style 4–6 mm long, sharply curved proximally, bony, subulate, slightly angled only on the base; stigma 4–4.5 mm long, broad linear, brown, papillose, running to the tip; endocarp centering in lower $\frac{1}{3}$, but extending to the base, the walls cartilaginous, pale; seed 3.5–4.5 mm long, more or less barrel-shaped; apical mesocarp hemispheric, with the center hollow; basal mesocarp sparse, with strong fibers up the sides.

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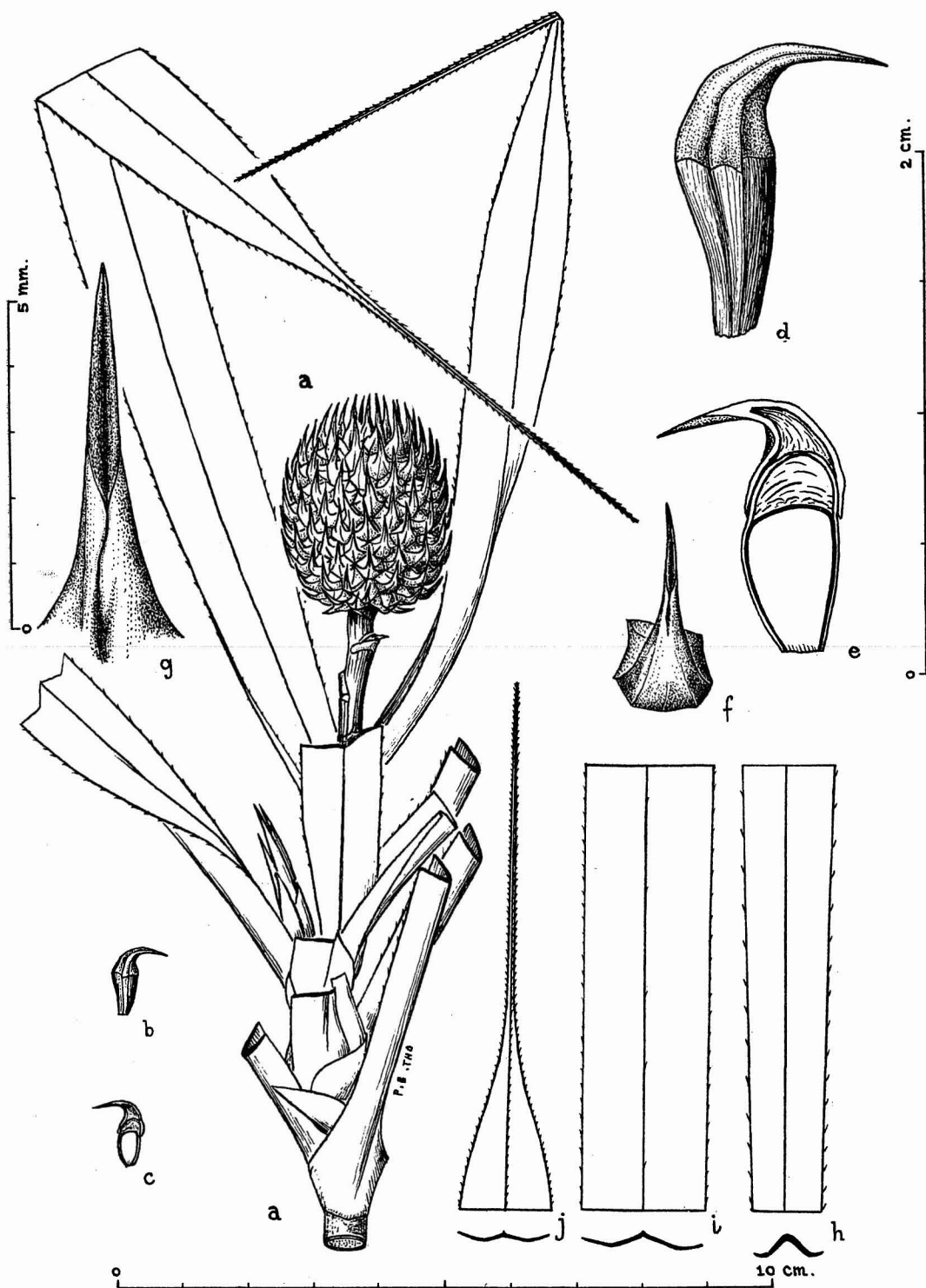


FIG. 150. *Pandanus attenuatus* St. John, from holotype. *a*, Habit, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, apical view, $\times 4$; *g*, style and stigma, oblique view, $\times 10$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

HOLOTYPE: Malaya, Selangor, Gunong Ielu Semangkok, 28 April 1922, I. H. Burkill 8,876 (SING).

SPECIMENS EXAMINED: Malaya, Selangor, Gap Sempadang, 1908, Hashin (SING).

DISCUSSION: *P. attenuatus* is a member of the section *Acrostigma*, as is its closest relative, the Malayan *P. unguiculatus* Ridl., which has the leaves 21–27 mm wide, at midsection with 17–19 secondary veins in each half; syncarp 5.5 cm long; drupes 18–20 mm long; the seed 7–8 mm long, suprabasal; and the style 2.5–3 mm long. *P. attenuatus* has the leaves 18–20.5 mm wide, at midsection with 14–15 secondary veins in each half; syncarp 3–3.5 cm long; drupes 13–13.5 mm long; seed 3.5–4.5 mm long, basal; and the style 4–6 mm long.

The new epithet is the Latin word *attenuatus*, drawn out, which is given in allusion to the attenuate subulate leaf apex.

Pandanus caudatifolius, nom. nov. (sect. *Acrostigma*)

Fig. 151

P. globuliferus Ridl., R. Asiat. Soc., Straits Br., Jour. 61: 42, 1912; non Thouars (1808).

DIAGNOSIS OF HOLOTYPE: "Stems up to 1 m tall," 6–7 mm in diameter, yellowish, smooth; leaves 33–37 cm long, at the middle 15–17 mm wide, near the base 10–11 mm wide, firm chartaceous, dark green above, pale below, almost flat except at base, swordlike, tapering in lower $\frac{1}{3}$ to the narrower base, in upper $\frac{1}{3}$ rather sharply narrowed to the 7 cm subulate apex, this 5 cm down 1 mm wide, the secondary parallel veins conspicuous and at midsection 15 in each half, no visible tertiary cross veins, the base widened and amplexicaul, unarmed, but beginning at 2–2.5 cm the margins with prickles 0.8–1 mm long, 2–4 mm apart, subulate, straight or arcuate, ascending, pale; the midrib below unarmed for lower $\frac{3}{4}$; at midsection the margins with subulate tipped serrae 0.2–0.3 mm long, 1.5–3 mm apart; on the caudate triangular apex the margins and midrib below with prickles 0.5–0.9 mm long, 1–3.5 mm apart, stout subulate, arcuate, ascending; peduncle 3 cm long; syncarp 18 mm in diameter, globose, bearing about 40 drupes, these 11–13 mm long, 3.5–4 mm wide,

2–3 mm thick, the body oblanceoloid, compressed, narrowed to the subulate style, 5–6 angled, the body 8–9 mm long; pileus 6–7 mm long, its base the widest part of the drupe, the lower part pyramidal-semiorbicular; style 3–4 mm long, subulate, ascending arcuate; stigma distal, 2.5–3 mm long, linear, extending to apex, brown, papillose; endocarp in lower $\frac{1}{4}$, obconic, the base obtuse, stramineous, dull, cartilaginous, the walls 0.2 mm wide; apical mesocarp 3.5–4 mm long, a cavern filled with white medullary membranes and hairs; basal mesocarp sparse, the margins fibrous, the center fleshy.

HOLOTYPE: Malaya, Selangor, Gunong Semangkok, 4,000 ft. alt., April 1894, H. N. Ridley 15,612 (SING).

DISCUSSION: *P. caudatifolius* is a member of the section *Acrostigma*, as is its closest relative, *P. globosus* St. John, a Malayan species with the leaves 11–12 mm wide, little if at all narrowed towards the base, at midsection the margins with prickles 1–1.5 mm long, 2–5 mm apart, subulate; drupes 14–17 mm long; and the style 3–6 mm long. *P. caudatifolius* has the leaves 15–17 mm wide near the middle, ligulate, narrowed below and near the base 10–11 mm wide, at midsection the margins with subulate-tipped serrae 0.2–0.3 mm long, 1.5–3 mm apart; drupes 11–13 mm long; and the style 3–4 mm long.

The epithet is derived from *caudatus*, having a tail, and *folium*, leaf, given in reference to the appearance of the leaf.

Pandanus globulosus sp. nov. (sect. *Acrostigma*)

Fig. 152

DIAGNOSIS HOLOTYPE: Frutex, caulibus in apice 6–7 mm diametro laevibus lucidis lutescentibus, foliis 38–42 cm longis 11–12 mm latis firme chartaceis supra obscure viridibus infra pallide viridibus et ad basem purpureis 1-costatis licet paene planis, in sectione mediali cum 12–14 nervis parallelis secundariis in quoque dimidio eis ubique prominentis, nervis tertialis nullis, laminis ligulatis subabrupte contractis in apice caudato subulato 5.5–6.5 cm longo 0.5 mm lato basi amplexicauli inermi conspicue nervosa ex 2–3 cm marginibus cum aculeis 0.5–0.9 mm longis 2.5–7 mm distantibus subulatis proxime adscendentibus pallidis, midnervo per 30 cm in-

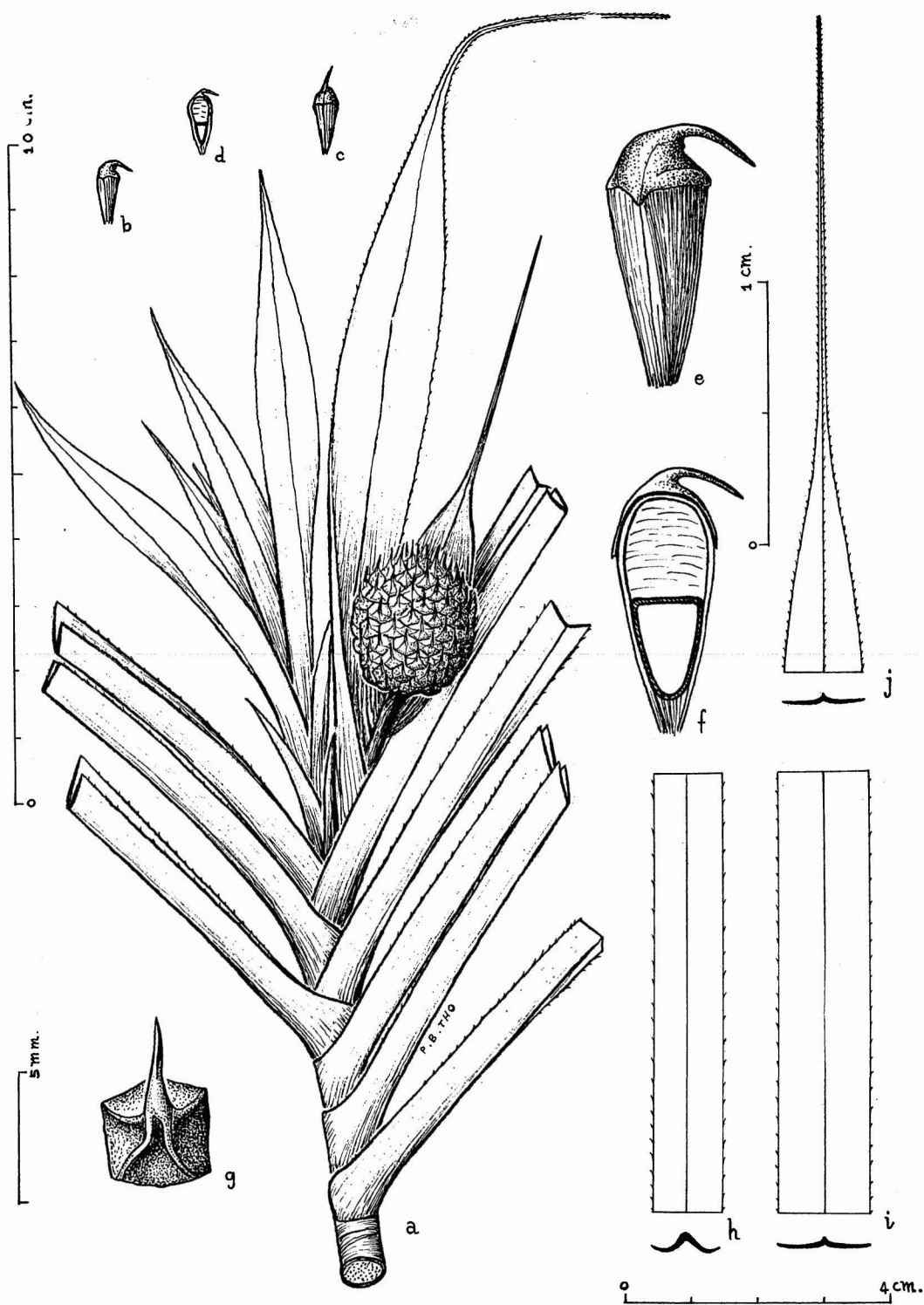


FIG. 151. *Pandanus caudatifolius* St. John, from holotype. *a*, Habit, $\times 1$; *b*, *c*, drupes, lateral view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e*, drupe, lateral view, $\times 4$; *f*, drupe, longitudinal median section, $\times 4$; *g*, drupe, apical view, $\times 4$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

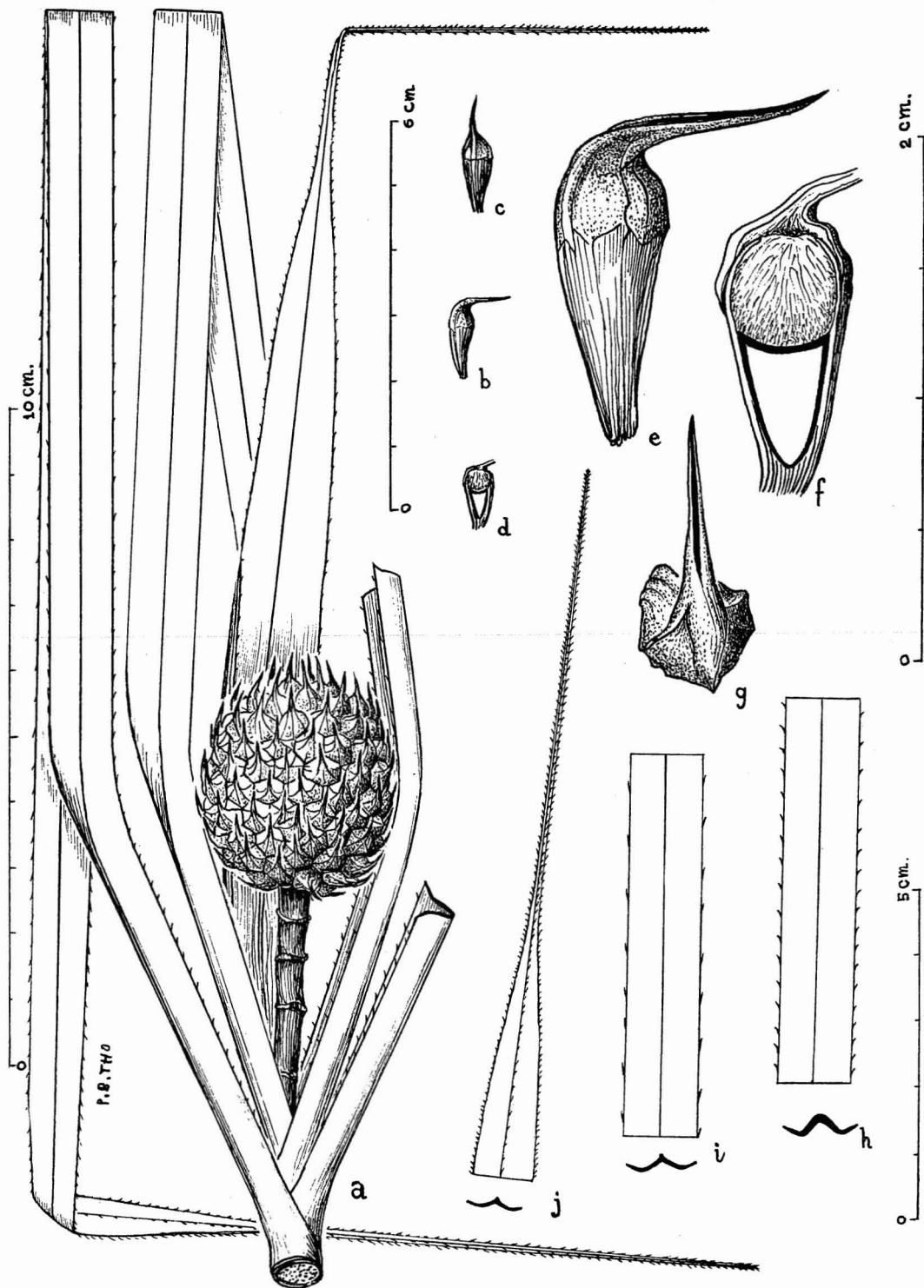


FIG. 152. *Pandanus globulosus* St. John, from holotype. *a*, Habit, $\times 1$; *b*, *c*, drupes, lateral view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e*, drupe, lateral view, $\times 4$; *f*, drupe, longitudinal median section, $\times 4$; *g*, drupe, style, and stigma, apical view, $\times 4$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

ermi, in sectione mediali marginibus cum aculeis 1–1.5 mm longis 2–5 mm distantibus proxime adscendentibus subulatis, in apice caudato marginibus et midnervo infra cum aculeis 0.7–1 mm longis 0.7–3.5 mm distantibus subulatis adscendentibus, inflorescentia foeminea terminali erecta cum uno syncarpio, pedunculo 4–6 cm longo 3–4 mm diametro trigono bracteato, syncarpio 2.5–3.5 cm longo 2.3–3 cm diametro globoso vel elliptici-globoso cum circa 96–120 drupis eis 14–17 mm longis 3–4.5 mm latis crassisque fusiformibus sed apice angustiori 5–6-anguloso, corpore 9–10 mm longo oblanceolideo, pileo 7–11 mm longo basi 3–5 mm alta ovoidea vel oblato-ovoidea cum 5 angulis prominentibus laevibus, stylo 3–6 mm longo proxime arcuato subulato rigido, stigmate 2–3 mm longo lineari distali brunneo papilloso in apice extento, endocarpio in parte $\frac{1}{3}$ infera obconico lateribus 0.2 mm crassis cartilagineis stramineis, mesocarpio apicali suborbiculari cum membranis albis radiatis numerosis, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Shrub; stems at summit 6–7 mm in diameter, smooth, shining, yellowish; leaves 38–42 cm long, 11–12 mm wide, firm chartaceous, dark green above, pale green below and with a small area near the base purple, 1-ribbed, apparently almost flat, at midsection with 12–14 parallel secondary veins in each half, these prominent throughout, no visible tertiary cross veins, the blade ligulate, rather abruptly contracted to a 5.5–6.5 cm subulate, caudate apex, this 0.5 mm wide, the base amplexicaul and unarmed, prominently veiny, beginning at 2–3 cm up the margins with prickles 0.5–0.9 mm long, 2.5–7 mm apart, subulate, closely ascending, pale; midrib unarmed for about 30 cm; at midsection the margins with prickles 1–1.5 mm long, 2–5 mm apart, closely ascending, subulate; on the caudate apex the margins and midrib below with prickles 0.7–1 mm long, 0.7–3.5 mm apart, subulate, ascending; pistillate inflorescence terminal, erect, bearing 1 syncarp; peduncle 4–6 cm long, 3–4 mm in diameter, 3-sided, bracteate; syncarp 2.5–3.5 cm long, 2.3–3 cm in diameter, globose or elliptic-subglobose, bearing about 96–120 drupes, these 14–17 mm long, 3–4.5 mm wide and thick, fusiform but the tip more slender,

5–6-angled, the body 9–10 mm long, oblanceoloid; pileus 7–11 mm long, the base 3–5 mm high, ovoid or oblate-ovoid, with 5 prominent angles, smooth; style 3–6 mm long, curved proximally, subulate, rigid; stigma 2–3 mm long, linear, distal, brown, papillose, running to the tip; endocarp in lower $\frac{1}{3}$, obconic, the walls 0.2 mm thick, cartilaginous, stramineous; apical mesocarp suborbicular, with numerous radial, white membranes; basal mesocarp sparse, fibrous and fleshy.

HOLOTYPE: Malaya, Pahang, Telom ridge, Nov. 1908, H. N. R[idley] 13,798 (SING).

DISCUSSION: *P. globulosus* is a member of the section *Acrostigma*, as is its closest relative, the Malayan species *P. caudatifolius* St. John. Under that species is given a summary of the contrasting differences.

The epithet is the Latin adjective *globulosus*, like a little sphere, and is chosen with reference to the shape of the syncarp.

Pandanus mollifoliaceus sp. nov. (sect. *Acrostigma*)

Fig. 153

DIAGNOSIS HOLOTYPI: Frutex, caule in apice 8 mm diametro luteo laevi, foliis 45–47 cm longis 23–29 mm latis molliter chartaceis supra viridibus infra pallide viridibus et videtur glaucis 1-sulcatis 2-plicatis in sectione mediali cum 17–18 nervis secundariis parallelis in quoque dimidio eis ubique prominentibus, circa apicem infra nervis tertialis reticulum cum sectionibus oblongis formantibus, lamina ligulata circa mediam latissima proxima basem 14–15 mm latis, in 6.5 cm apice caudato subiter diminuentibus eo 5 cm ex apice 0.7 mm lato, basi amplexicauli inermi et nervis exevidentibus, marginibus ex 3 cm cum aculeis 1–1.5 mm longis 2–5 mm distantibus subulatis pallidis in 45° adscendentibus, midnervo per 35 cm inermi, in sectione mediali marginibus cum aculeis 0.5–1 mm longis 4–10 mm distantibus subulatis adpresse adscendentibus, in apice contractenti marginibus cum aculeis 0.8–1.7 mm longis 2.5–3.5 mm distantibus divergentibus, midnervo infra cum aculeis simulantibus 4–7 mm distantibus, in apice caudato marginibus et midnervo infra cum subulato-serrulis 0.5–0.9 mm longis 2–4 mm distantibus, inflorescentia foeminea terminali erecta cum uno

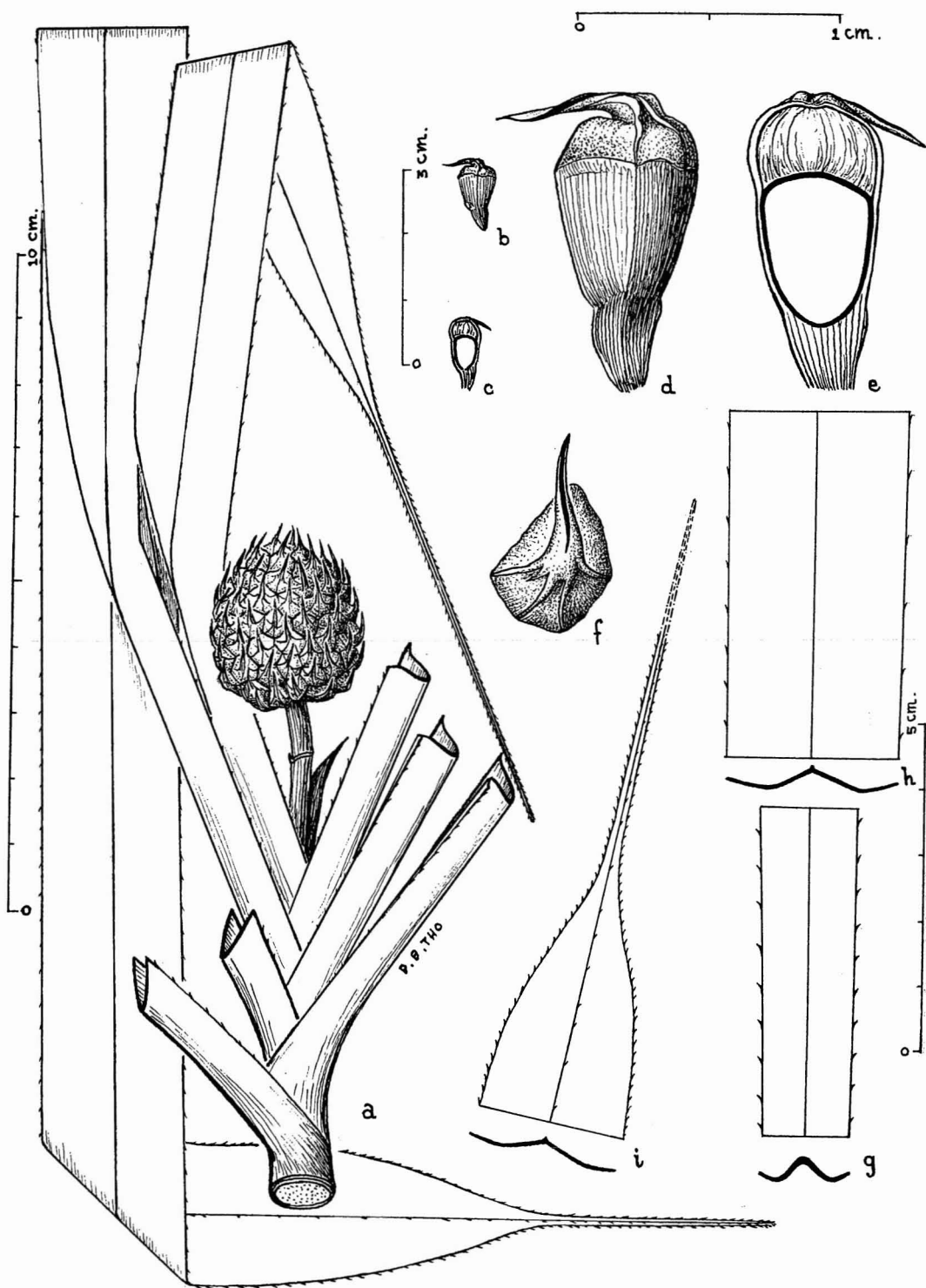


FIG. 153. *Pandanus mollifoliaceus* St. John, from holotype. *a*, Habit, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe, style, and stigma, apical view, $\times 4$; *g*, leaf base, lower side, $\times 1$; *h*, leaf middle, lower side, $\times 1$; *i*, leaf apex, lower side, $\times 1$.

capite, pedunculo 3 cm longo 3 mm diametro trigono bracteoso, syncarpio 2.7 cm longo 2.3 cm diametro subgloboso cum circa 120 drupis eis 8–10 mm longis (vel in curvatura styli sequi 12–15 mm) 4–5 mm latis 3–4 mm crassis corpore oblongo-ovoideo 5-anguloso lateribus striatis, pileo cum basi 2 mm alta pulviniformi 5-angulato minute striato, stylo 4–5 mm longo proxime in angulo recto curvato recto vel sinuoso subulato gracile firmo in dimidia infera anguloso, stigmatibus 3–4 mm longo lineari distali brunneo paene in apice extento, endocarpio in tertia infera 5–6 mm longo late obovoideo lateribus 0.2 mm crassis cum fibris longitudinalibus fortibus et membrano gracili pallidi, mesocarpio apicali cavernoso cum membranis medullosis albis paucis, mesocarpio basali carnosum et cum fibris tenuibus.

DIAGNOSIS OF HOLOTYPE: Shrub; stem 8 mm in diameter at apex, yellowish, smooth; leaves 45–47 cm long, 23–29 mm wide, soft chartaceous, green above, pale green and apparently glaucous below, 1-ribbed, 2-pleated, at midsection with 17–18 parallel secondary veins in each side, these prominent throughout, and on the lower side near the tip with barely visible cross tertiary veins making irregular oblong meshes, the blade ligulate, though broadest at or beyond the middle, near the base 14–15 mm wide, abruptly contracted to a 6.5 cm caudate tip, this 5 cm down 0.7 mm wide, the base amplexicaul, unarmed, the veins obscure, beginning 3 cm up the margins with prickles 1–1.5 mm long, 2–5 mm apart, subulate, pale ascending at about 45°; the midrib unarmed for about 35 cm; at midsection the margins with prickles 0.5–1 mm long, 4–10 mm apart, subulate, closely ascending; on the subapical contracting region the margins with prickles 0.8–1.7 mm long, 1.5–2.5 mm apart, divergent, and those of the midrib below similar but 4–7 mm apart; on the caudate tip the margins and midrib below with subulate serrulations 0.5–0.9 mm long, 2–4 mm apart; pistillate inflorescence terminal, erect, bearing one head; peduncle 3 cm long, 3 mm in diameter, 3-sided, bracteate; syncarp 2.7 cm long, 2.3 cm in diameter, subglobose, bearing about 120 drupes, these 8–10 mm long (or following the curve of the style 12–15 mm), 4–5 mm wide, 3–4 mm thick, the body oblong-obovoid,

5-angled, the sides striate; pileus with the base 2 mm high, cushion-shaped, 5-angled, finely striate; style 4–5 mm long, proximally ascending at right angles, straight or twisting, slender subulate, firm, angled in lower half; stigma 3–4 mm long, linear, distal, brown, running almost to the tip; endocarp centering in lower $\frac{1}{3}$, and 5–6 mm long, broadly obovoid, the walls 0.2 mm thick, of heavy longitudinal fibers and a thin connecting membrane, pale; apical mesocarp a broad cavern with a few white medullary membranes; basal mesocarp fleshy and with weak fibers.

HOLOTYPE: Malaya, Negri Sembilan, Gunung Angsi, eastward on ridge, 2,600 ft. alt., 24 Nov. 1923, *Mohamed Nur* 11,691 (SING).

DISCUSSION: *P. mollifoliaceus* is a member of the section *Acrostigma*, as is its closest relative, *P. caudatifolius* St. John, of Malaya, a species with its leaves 15–17 mm wide, firm chartaceous, tapering from the middle downwards and near the base only 10–11 mm wide, at midsection the leaf margins with subulate tipped serrae 0.2–0.3 mm long, 1.5–3 mm apart; syncarp 18 mm in diameter, globose, bearing about 40 drupes; drupes with the body oblanceolate, the sides smooth; pileus base pyramidal-semiorbicular; stigma 2.5–3 mm long; endocarp in lower $\frac{1}{4}$, obconic; and the apical mesocarp longer than wide. *P. mollifoliaceus* has its leaves 23–29 mm wide, soft chartaceous, tapering downwards and near the base 14–15 mm wide, at midsection the leaf margins with prickles 0.5–1 mm long, 4–10 mm apart, subulate; syncarp 2.7 cm long, 2.3 cm in diameter, subglobose, bearing about 120 drupes; drupes with the body oblong-obovoid, the sides striate; pileus base cushion-shaped; stigma 3–4 mm long; endocarp in lower $\frac{1}{3}$, broadly obovoid; and the apical mesocarp wider than long.

The new epithet is formed from the Latin *mollis*, soft; *foliaceus*, leafy, in reference to the soft texture of the leaves.

Pandanus albibracteatus sp. nov. (sect. *Pandanus*)

Figs. 154, 155, 169, 170a

DIAGNOSIS HOLOTYPE: Arboriformis, caulibus 8 m altis 15 cm diametro viridarium formans, cortice brunneo muricato, radicibus fulturosis 1

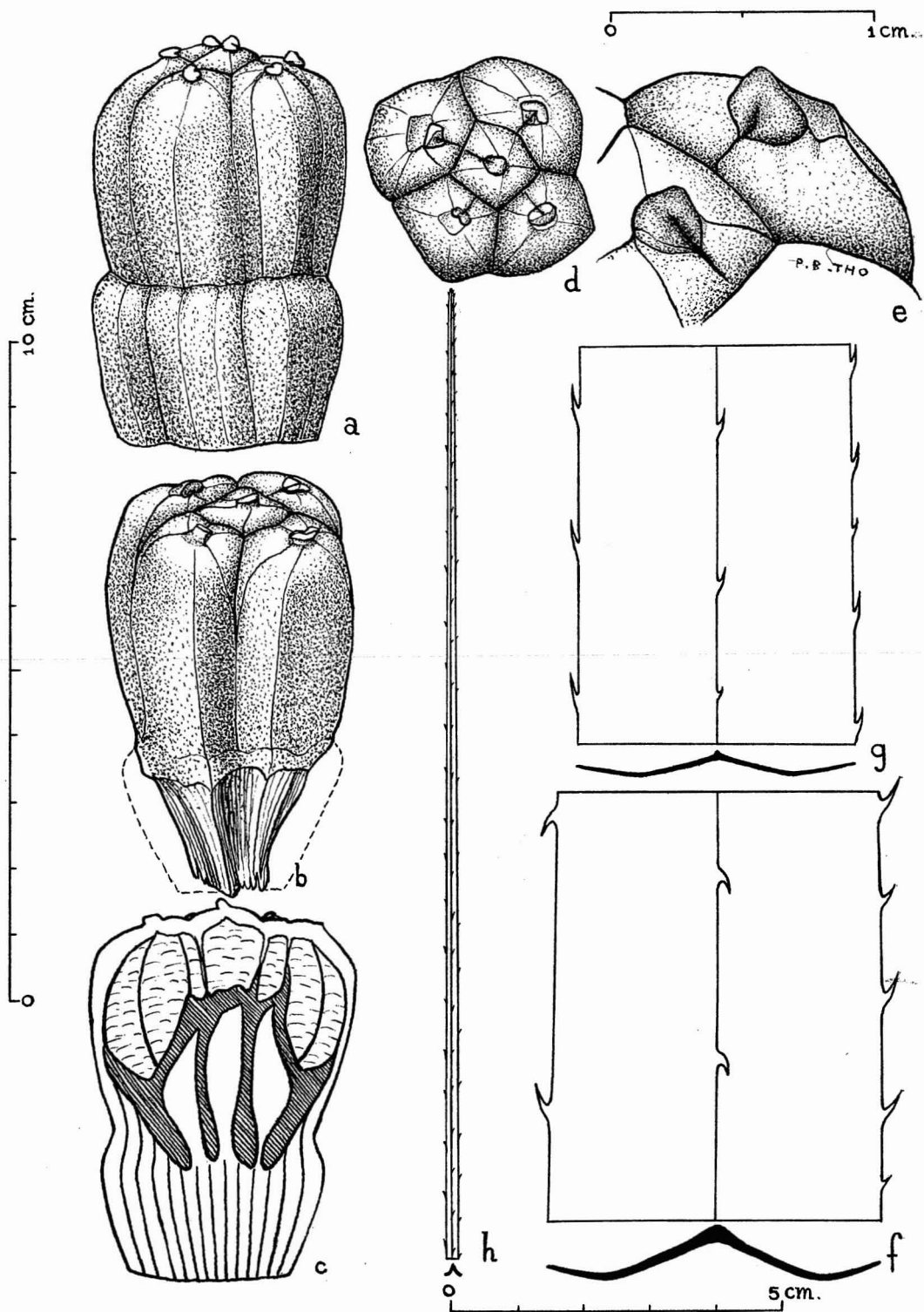


FIG. 154. *Pandanus albibracteatus* St. John, from holotype. *a*, Fresh drupe, lateral view, $\times 1$; *b*, dried drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, apical view, $\times 1$; *e*, carpel apices, stigmas, and proximal sinuses, oblique view, $\times 4$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

m longis 3–4 cm diametro in lineis muricatis, foliis 1.72–1.97 m longis 5–5.5 cm latis coriaceis olivaceo-viridibus supra glaucis infra glaucioribus supra midnervum sulcatis 2-plicatis in sectione mediali cum 41–44 nervis parallelis secundariis in quoque medio nervis tertialis nullis infero folii ligulato medio exteriori gladi-formati sensim in apice 40 cm longo caudato subulato trigono diminuenti eo 10 cm ex apice 0.9 mm lato, basi amplexicauli et inermi sed ex 2–6 cm marginibus cum aculeis 4.5–7 mm longis 10–45 mm separatis subulatis rectis vel arcuatis apicibus rubro-brunneis plerumque adscendentibus, midnervo infra cum aculeis 3.5 mm longis 20–45 mm separatis conico-subulatis reflexis, in sectione mediali marginibus cum aculeis 3–5 mm longis 7–20 mm separatis subulatis adpresse adscendentibus, midnervo infra cum aculeis 3.5–4 mm longis 22–28 mm separatis crassiter subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum subulato-serrulis 0.3–0.5 mm longis 4–10 mm separatis; inflorescentia foeminea terminali arcuata cum syncarpio solitario, pedunculo 27 cm longo 13–20 mm diametro trigono folioso-bracteato, syncarpio 23 cm longo 17.5 cm diametro ellipsoide-subgloboso cum 67 phalangibus, nucleo maturo molli et carnosio subito contracto in reliquum minutum, phalangibus 5.5–6.2 cm longis dimidio supero 3.2–4 cm lato 2.5–3.5 cm crasso oblongo-ellipsoideo vel obovoideo infra aurantiaco-rubro supra subviridibus, deinde rosaceo 5–6-anguloso lateribus laevibus sublucidis subconvexis, suturis lateralibus plerumque nullis rariter 1 (–2), apice convexo, sinibus apicalibus centralibus 0.7–2 mm profundis V-formatis in fondam plerumque rectis, dimidio infero phalangiis 3.3–4.2 cm latis 2.8–3.9 cm crassis carnosio-incrassatis rosaceo-aurantiacis cuneato-oblongis humeris 3–6 mm latis 5–8-angulosis lateribus gradatim curvatis carne saccharosa innoxia sed non consumpta, carpellis 4–7 eis centralibus $\frac{2}{3}$ tam grandibus quam marginalibus, apicibus depresso-conico eis marginalibus asymmetricis et aliquis cum plano vel concavo distalo stigmatibus 2.5–4 mm longis cordatis vel deltoideis vel reniformibus pallide brunneis papillosis sulcatis obliquis centripetalibus, sinibus proximalibus $\frac{1}{2}$ – $\frac{2}{3}$ ad fondam extensis, endocarpio minime supra-mediali osseoso mahogani-colorato intra lucido

lateribus 5 mm crassis, seminibus 12–15 mm longis 5 mm diametro ellipsoideis, mesocarpio supero in quoque apice cavernam cum fibris paucis et membranis albis medullosis multis formantibus, mesocarpio basali grande fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Treelike; stems 8 m tall, 15 cm in diameter, forming a large clump; bark brown, muricate; prop roots 1 m long, 3–4 cm in diameter, muricate in lines; leaves 1.72–1.97 m long, 5–5.5 cm wide, coriaceous, olive green, above glaucous and more so below, broad furrowed above the midrib, and with 2 rounded pleats, at midsection with 41–44 secondary parallel veins in each half, no tertiary cross veins, lower half ligulate, outer half sword-shaped, gradually tapering to a 40 cm caudate subulate trigonous apex, this 10 cm down only 0.9 mm wide, the base amplexicaul and unarmed, but beginning at 2–6 cm the margins with prickles 4.5–7 mm long, 10–45 mm apart, subulate, mostly ascending, straight or arcuate, red-brown-tipped; the midrib below with prickles 3–5 mm long, 20–45 mm apart, conic-subulate, reflexed; at midsection the margins with prickles 3–5 mm long, 7–20 mm apart, subulate, appressed ascending; the midrib below with prickles 3.5–4 mm long, 22–28 mm apart, stout subulate, ascending; on the subulate apex the margins and midrib below with subulate-serrulations 0.3–0.5 mm long, 4–10 mm apart; pistillate inflorescence terminal, arching, bearing one syncarp; peduncle 27 cm long, 13–20 mm in diameter, 3-sided, leafy bracted; syncarp 23 cm long, 17.5 cm in diameter, ellipsoid-subglobose, bearing 67 phalanges, the ripe core soft and fleshy and quickly shrivelling to a very small remnant; phalanges 5.5–6.2 cm long, the upper half 3.2–4 cm wide, 2.5–3.5 cm thick, oblong-ellipsoid or obovoid, below orange-red, above greenish changing to pink, 5–6-angled, the sides smooth, a little shiny, gently curved, lateral sutures usually none, rarely 1 (–2), the apex convex; central apical sinuses 0.7–2 mm deep, V-shaped at the very bottom, mostly straight; lower half of phalange 3.3–4.2 cm wide, 2.8–3.9 cm thick, fleshy enlarged, pinkish orange, cuneate-oblong in outline, the shoulders 3–6 mm wide, often eaten by small, black ants, and reduced to white scars, 5–8-angled, the sides

smooth, gently curved, the flesh sweet, inoffensive, but not eaten; carpels 4–7, the central ones about $\frac{2}{3}$ as large as the marginal, the apices very low conic, the marginal ones asymmetric and some of them having just distal of the stigma a slight flat platform or even a concavity; stigmas 2.5–4 mm long, from cordate to deltoid or reniform, light brown, papillose, creased, oblique, centripetal; proximal sinus running $\frac{1}{2}$ – $\frac{2}{3}$ way to valley bottom; endocarp slightly suprmedian, bony, mahogany-colored, the inner surfaces shining, the lateral walls 5 mm thick; seeds 12–15 mm long, 5 mm in diameter, ellipsoid; upper mesocarp forming in the apex of each carpel a cavern with a few fibers but filled with aerenchyma of white medullary membranes; basal mesocarp fibrous and fleshy, extensive.

DESCRIPTION OF STAMINATE TREE: Tree 7 m tall, 12 cm in diameter; bark brown, muricate; prop roots none, but tree abused; leaves 1.23 m long, 3.9–4 cm wide, coriaceous, furrowed above the midrib, the sides not plicate, at midsection with 35 secondary parallel veins in each half, no tertiary cross veins, sword-shaped, tapering into a 15–20 cm subulate trigonous apex, this 10 cm down, 3 mm wide; at 3–4.5 cm from the base the margins with prickles 4–5 mm long, 7–21 mm apart, arcuate subulate, with thickened base, ascending; the midrib below beginning at 6–7 cm with prickles 3–4.5 mm long, 4–22 mm apart, similar but reflexed; at midsection the margins with prickles 1.5–2.5 mm long, 6–12 mm apart, subulate, closely appressed ascending; the midrib below with prickles 1.5–2 mm long, 13–25 mm apart, subulate, arcuate ascending; the subulate apex with margins and midrib below with prickles 0.5–0.7 mm long, 3–7 mm apart, subulate-serrations; staminate inflorescence single, terminal, arcuate and pendent, 50 cm long; peduncle fleshy and soon disintegrating; lower bracts with lower part and the other bracts all white; lowest floral bract 48 cm long, 2.2 cm wide, the body ligulate except at base with marginal prickles 2–2.5 mm long, acrose, ascending, closely appressed, white; the apex 20–25 cm long, subulate, foliaceous; median bract 19 cm long, 2.6 cm wide, linear-lanceolate, unarmed except near the tip; spikes about 12, dense, 2.5–4 cm long, 1.5–2 cm in diameter,

cylindric; staminate flowers very numerous, 1.5–1.9 cm long; column 4–8 mm long, bearing a common section of equal length and with about 24 stamens, the free filament tips 1–2 mm long; anther body 2.4–3.6 mm long, linear-lanceolate, bearing an apical subulate prolongation of the connective 0.6–0.7 mm long.

HOLOTYPE: Malaya, Penang Island, 5 miles n. of George Town, top of sea beach, June 30, 1960, *H. St. John* 26,371 (BISH).

SPECIMENS EXAMINED: Malaya, Penang Island, Tanjong Tokong, 6 miles n. of George Town, top of sea beach, staminate, June 30, 1960, *H. St. John* 26,370 (BISH); Penang Island, Mt. Pleasure, 8 miles n. of George Town, top of quartz sand sea beach, clump with stems cut back to 1 m. by 10 cm, old phalanges from the ground, June 30, 1960, *H. St. John* 26,369 (BISH).

DISCUSSION: *P. albibracteatus* is a member of the section *Pandanus*, as is its closest relative, the Singapore species *P. Boryi* Gaud., which has the phalanges with the central apical sinuses 1.5–2.5 mm deep; marginal carpels with a visor projecting over the stigma; leaves 3.5–4.4 cm wide, sword-shaped, at midsection with 39 secondary parallel veins in each half, and near the base the margins with prickles 3–4.5 mm long, 7–25 mm apart. *P. albibracteatus* has the phalanges with the central apical sinuses 0.7–2 mm deep; stigmas lacking a visor; leaves 5–5.5 cm wide, the lower half ligulate, the outer half sword-shaped, secondary parallel veins 41–44 at midsection in each half, near the base the margins with prickles 4.5–7 mm long and 10–45 mm apart.

The new epithet is formed from the Latin words *albus*, white; *bracteatus*, with bracts, and given in allusion to the white floral bracts.

Pandanus ambiglaucus sp. nov. (sect. *Pandanus*)

Figs. 156, 170b

DIAGNOSIS HOLOTYPI: Arbor juvenalis, trunco erecto 1 m alto 10 cm diametro, radicibus fulturosis ad 1 m longis et 4 cm diametro brunneis in lineis sparse muriculatis, foliis 2–2.47 m longis 5.8–6.3 cm latis coriaceis viridibus et glaucis in lateribus ambis, spinis omnibus albis, lamina late sulcata et dimidiis subsigmoi-

deis in sectione mediali cum 44–46 nervis parallelis secundariis in quoque dimidio, nervis tertialis nullis, gladiformatis sensim in apice trigono subulato caudato 20–30 cm longo diminuentibus eo 10 cm ex apice 1.8 mm lato, basi amplexicauli et inermi sed ex 5–6 cm marginibus cum aculeis 4–6 mm longis 5–26 mm separatis valde subulatis arcuatis adscendentibus, midnervo infra ex 7.5–8.5 cm cum aculeis 3–4.5 mm longis 20–32 mm separatis arcuatis subulatis reflexis basibus crassis, in sectione mediali marginibus cum aculeis majoribus 2.5–3 mm longis 18–30 mm separatis arcuatis subulatis adscendenti-adpressis basibus crassis plerumque alternantibus cum aculeis minoribus 1–2 mm longis, midnervo infra cum aculeis 1.5–2 mm longis 13–24 mm separatis subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum subulato-serrulis 0.3–1 mm longis 3–8 mm separatis, inflorescentia foeminea terminali arcuati, pedunculo 40 cm longo 2 cm diametro trigono folioso-bracteato cum syncarpio solitario eo 21 cm longo 16 cm diametro ellipsoideo (submaturo et viridi) cum 85 phalangibus eis 6–6.6 cm longis 2.8–4 cm latis 2.8–3.6 cm crassis obovoideis ad apicem infra cuneatis, apice convexo 5–6-anguloso lateribus supra convexis infra concavis (evidente immaturis), laevibus lucidis, suturis lateralibus nullis, sinibus apicalibus centralibus 0.5–2.5 mm profundis latis et vadosis rectis vel subcurvatis, carpelis 7–8 eis centralibus $\frac{1}{2}$ – $\frac{2}{3}$ tam grandibus quam illis marginalibus eis basalibus medialisque cum apicibus subplanis sed illis centralibus cum apicibus oblato-conicis, stigmatibus 2–3 mm longis suborbicularibus vel ellipticis obscure brunneis obliquis sulcatis centripetalibus, ceteris marginalibus truncatis, sinibus proximalibus $\frac{1}{2}$ ad fondam extentis, endocarpio in parte $\frac{1}{3}$ infera osseoso brunneo, seminibus 12–16 mm longis ellipsoideis, mesocarpio supero in quaque carpella cavernam cum fibris et membranis pallidis medullosis formanti, mesocarpio basali fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Young tree, trunk erect 1 m tall, 10 cm in diameter; prop roots up to 1 m long and 4 cm in diameter, sparsely muriculate in vertical lines, brown; leaves 2–2.47 m long, 5.8–6.3 cm wide, coriaceous, green and glaucous on both sides, the spines all white,

the blade broad furrowed over the midrib, the sides slightly sigmoid, at midsection with 44–46 secondary parallel veins in each half, no visible tertiary cross veins, sword-shaped, gradually tapering upwards into a 20–30 cm caudate, subulate, trigonous apex, this 10 cm down 1.8 mm wide, the base amplexicaul and unarmed, but beginning at 5–6 cm up the margins with prickles 4–6 mm long, 5–26 mm apart, stout subulate, arcuate, ascending; the midrib below beginning at 7.5–8.5 cm with prickles 3–4.5 mm long, 20–32 mm apart, arcuate subulate, heavy based, reflexed; at midsection the margins with larger prickles 2.5–3 mm long, 18–30 mm apart, arcuate subulate, heavy based, ascending appressed, mostly alternating with smaller ones 1–2 mm long; the midrib below with prickles 1.5–2 mm long, 13–24 mm apart, subulate, ascending; on the subulate apex the margins and midrib below with subulate serrulations 0.3–1 mm long, 3–8 mm apart; pistillate inflorescence terminal, arching; peduncle 40 cm long, 2 cm in diameter, 3-sided, leafy bracted, bearing a single syncarp, this 21 cm long, 16 cm in diameter, ellipsoid, slightly immature and still green, bearing 85 phalanges, these 6–6.6 cm long, 2.8–4 cm wide, 2.8–3.6 cm thick, obovoid above, cuneate below, the apex convex, 5–6-angled, the sides convex above, concave below (but this probably due to immaturity), smooth, shining; lateral sutures none; central apical sinuses 0.5–2.5 mm deep, shallow, the line straight or gently curved; carpels 7–8, the central ones $\frac{1}{2}$ – $\frac{2}{3}$ as large as the marginal ones, the basal and median phalanges with the carpel apices almost flat, but those near the center with the apices oblate conic; stigmas 2–3 mm long, suborbicular to elliptic, dark brown, oblique, creased, centripetal, some of the marginal ones truncate; proximal sinus running $\frac{1}{2}$ way to valley bottom; endocarp in lower $\frac{1}{3}$, bony, brown; seeds 12–16 mm long, ellipsoid; upper mesocarp forming in each carpel apex a cavern, with fibers and pale medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Singapore, Woodlands Road, 14 miles mark, opposite Kranji Nature Reserve, fresh water swamp, with *Dicranopteris linearis*, July 10, 1960, *H. St. John* 26,376 (BISH).

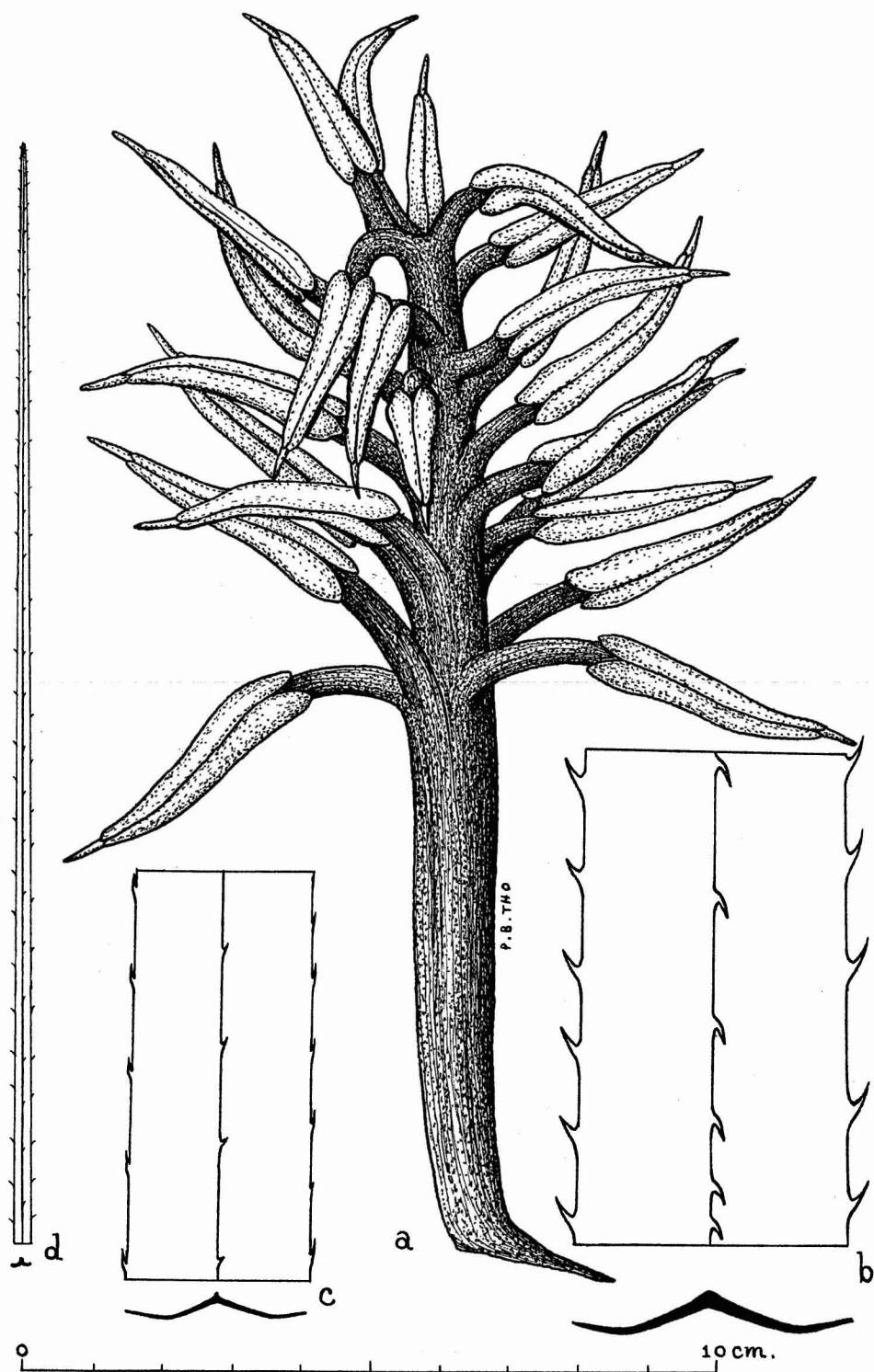


FIG. 155. *Pandanus albibracteatus* St. John, from *St. John* 26,370. *a*, Staminal column with anthers, lateral view, $\times 10$; *b*, leaf base, lower side, $\times 1$; *c*, leaf middle, lower side, $\times 1$; *d*, leaf apex, lower side, $\times 1$.

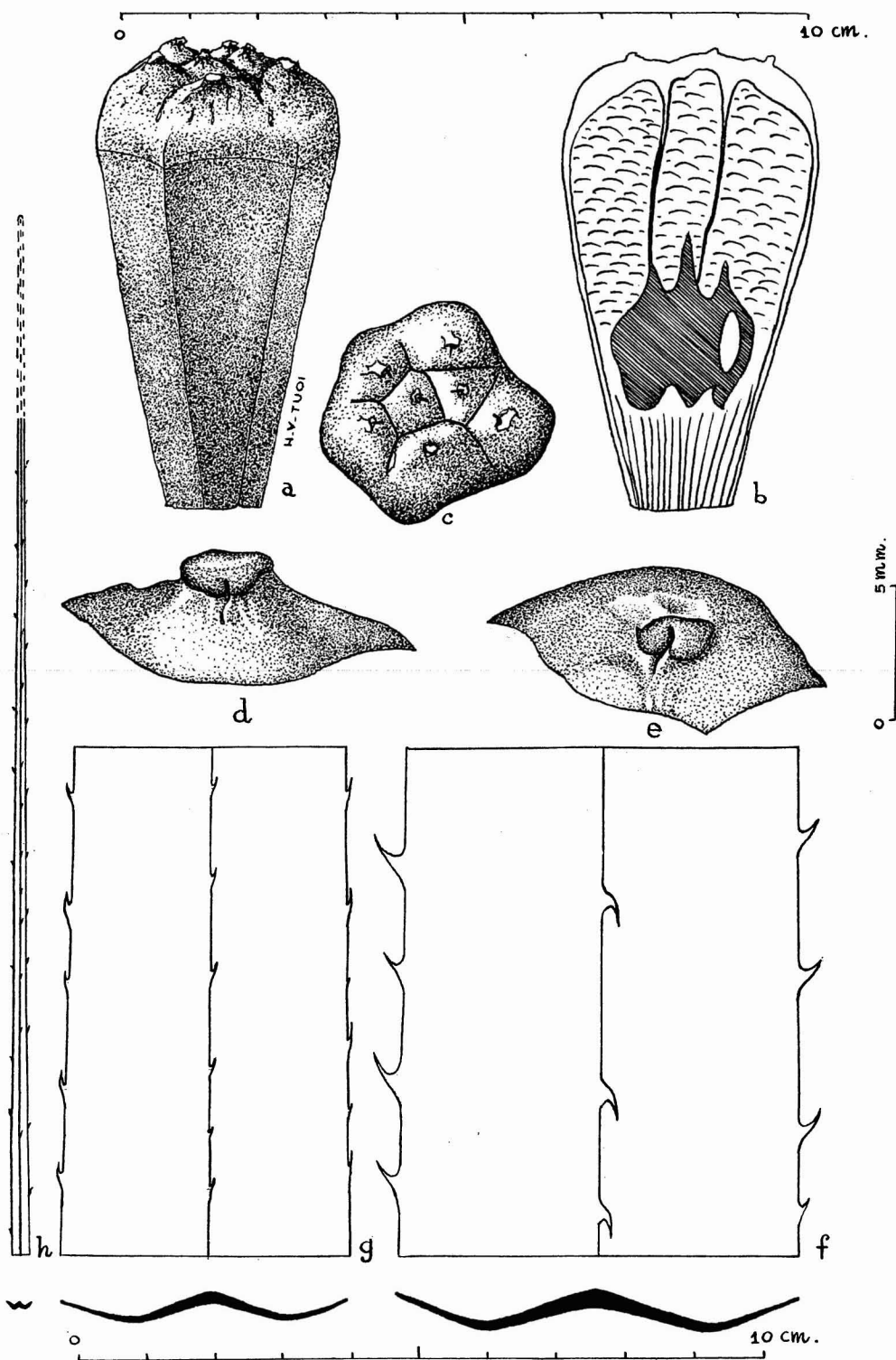


FIG. 156. *Pandanus ambiglaucus* St. John, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apex, stigma, and proximal sinus of a median phalange, oblique view, $\times 1$; *e*, carpel apex, stigma, and proximal sinus of a phalange near the base, oblique view, $\times 1$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

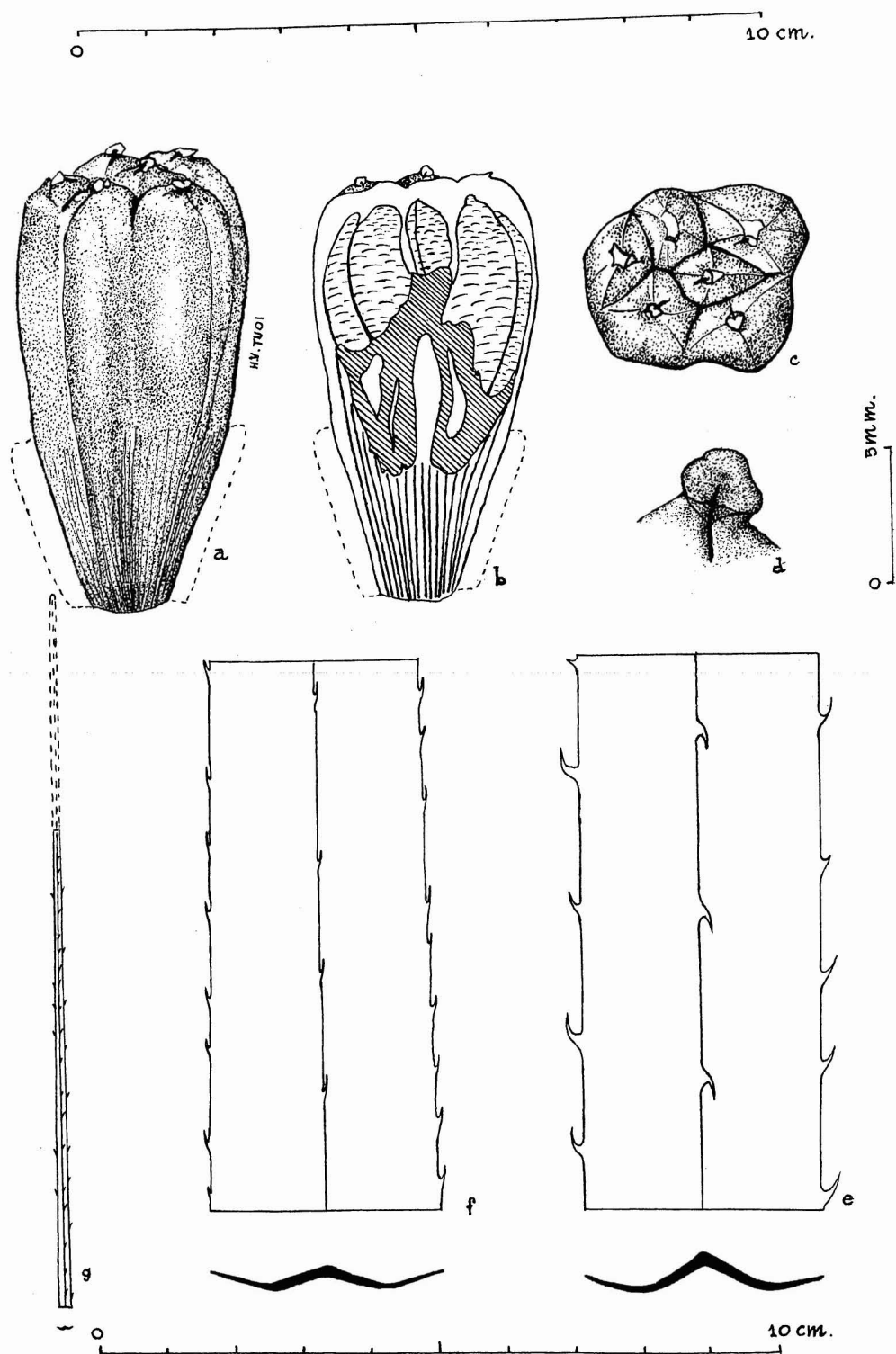


FIG. 157. *Pandanus Boryi* Gaud., from Singapore, Fosberg 36,919. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c*, phalange, apical view, $\times 1$; *d*, carpel apex, stigma, and proximal sinus, oblique view, $\times 1$; *e*, leaf base, lower side, $\times 1$; *f*, leaf middle, lower side, $\times 1$; *g*, leaf apex, lower side, $\times 1$.

DISCUSSION: *P. ambiglaucus* is a member of the section *Pandanus*, as is *P. inclinatus* St. John, also of Singapore, its closest relative, and a species with the syncarp with 44–61 phalanges, these with the apex truncate or subtruncate, and the lower half fleshy enlarged; endocarp median; leaves 1.5–1.7 m long, 4.4–4.7 cm wide, above dark olive green, below green; and the secondary veins at midsection 38–40 in each half. *P. ambiglaucus* has the syncarp with 85 phalanges, these with the apex convex, and the lower half cuneate; endocarp in the lower $\frac{1}{3}$; leaves 2–2.47 m long, 5.8–6.3 cm wide, green and glaucous on both sides; and the secondary veins 44–46 in each half at the midsection of the leaf.

The new epithet is from the Greek words *ambos*, both; *glaukos*, color of the sea, applied to the glaucous coating on both sides of the leaves.

Pandanus Boryi Gaud., Bot. Voy. La Bonite, pl. 22, f. 15, 1841

Fig. 157

Description from *Fosberg* 36,919, Singapore: "Small tree," leaves more than 1.64 m long, 3.5 cm wide, subcoriaceous, green above and below, channeled above the midrib, 2-pleated, in section M-shaped, at midsection with 39 parallel secondary veins in each half, no tertiary cross veins, sword-shaped, tapering gradually to the trigonous subulate tip, more than 15 cm long, and about 10 cm down, only 2.5 mm wide, the base amplexicaul and unarmed, but beginning at 4–7 cm the margins with prickles 3–4.5 mm long, 7–25 mm apart, arcuate, subulate, ascending, pale; the midrib below beginning at 19 cm with prickles 3 mm long, 25–40 mm apart, similar but reflexed; at midsection the margins with prickles 2–2.5 mm long, 8–15 mm apart, arcuate subulate, ascending appressed; the midrib below bearing similar prickles 1.7–2 mm long; on the subulate apex the margins and midrib below with serrulations 0.3–0.5 mm long, 3–8 mm apart, red-tipped. "...fruiting head small cylindric, red when ripe"; phalange 6.3 cm long, 3.4 cm wide, 2.8 cm thick, pyriform, compressed, when dried the apex brown, but yellowish below, the sides smooth, shining, gently curved, free in

upper $\frac{1}{3}$, the apex low convex, lateral sutures none (from the direction of the basal fibers and from the remnant of a shoulder, it is apparent that when fresh the basal third had fleshy enlargements); central apical sinuses 1.5–2.5 mm deep, broad; carpels 6, the apices very low, depressed pyramidal, the inner ones slightly the smaller; stigmas 2–2.5 mm wide, reniform, dark brown, papillose, centripetal and mostly oblique, some of the marginal ones with the apex truncate by an overhanging visor which terminates a distal concavity; proximal sinus running $\frac{1}{2}$ way to valley bottom; endocarp median, 3 cm long, bony, massive, dark mahogany-colored, the lateral walls 3 mm thick, the inner surfaces shining; seeds 12 mm long, 3–4 mm in diameter, ellipsoid; upper mesocarp forming in the apex of each carpel a cavern with few fibers but filled with aerenchyma of white medullary membranes; basal mesocarp fibrous and fleshy.

EXPANDED DESCRIPTION FROM OTHER SPECIMENS: Branch tips 4.5–5 cm in diameter, brown, with crowded leaf scars; leaves 1–1.64 m long, 3.5–4.5 cm wide, at midsection with 39–45 parallel secondary veins in each half, near the base the marginal prickles 3–5 mm long, those of the midrib below 3–5 mm long; peduncle terminal, 22 cm long, 15 mm in diameter, 3-sided, leafy bracted, bearing a single syncarp, this 16 cm long, 14 cm in diameter, broadly ellipsoid, bearing numerous phalanges; phalanges 5.5–6 cm long, 2–3.4 cm wide, 2–2.8 cm thick, pyriform to wedge-shaped, compressed; carpels 6–10.

STANDARD SPECIMEN: Singapore: edge of "dry" mangrove swamp, April 17, 1956, *F. R. Fosberg* 36,919 (US).

SPECIMENS EXAMINED: Singapore, Sungei Gunong, Feb. 1893, *H. N. Ridley* 5,003 (SING); Singapore, Dec. 15, 1904, *W. Fox* 12,575 (SING).

DISCUSSION: *P. Boryi* Gaud. is a member of the section *Pandanus*. The type specimen is a single phalange in the Paris museum, collected by Gaudichaud, and left without data. It was a misfortune that he abandoned his taxonomic work half done and devoted his last years to morphogenesis, producing lengthy papers that are now forgotten. *P. Boryi* was published with the binomial and with a figure showing a

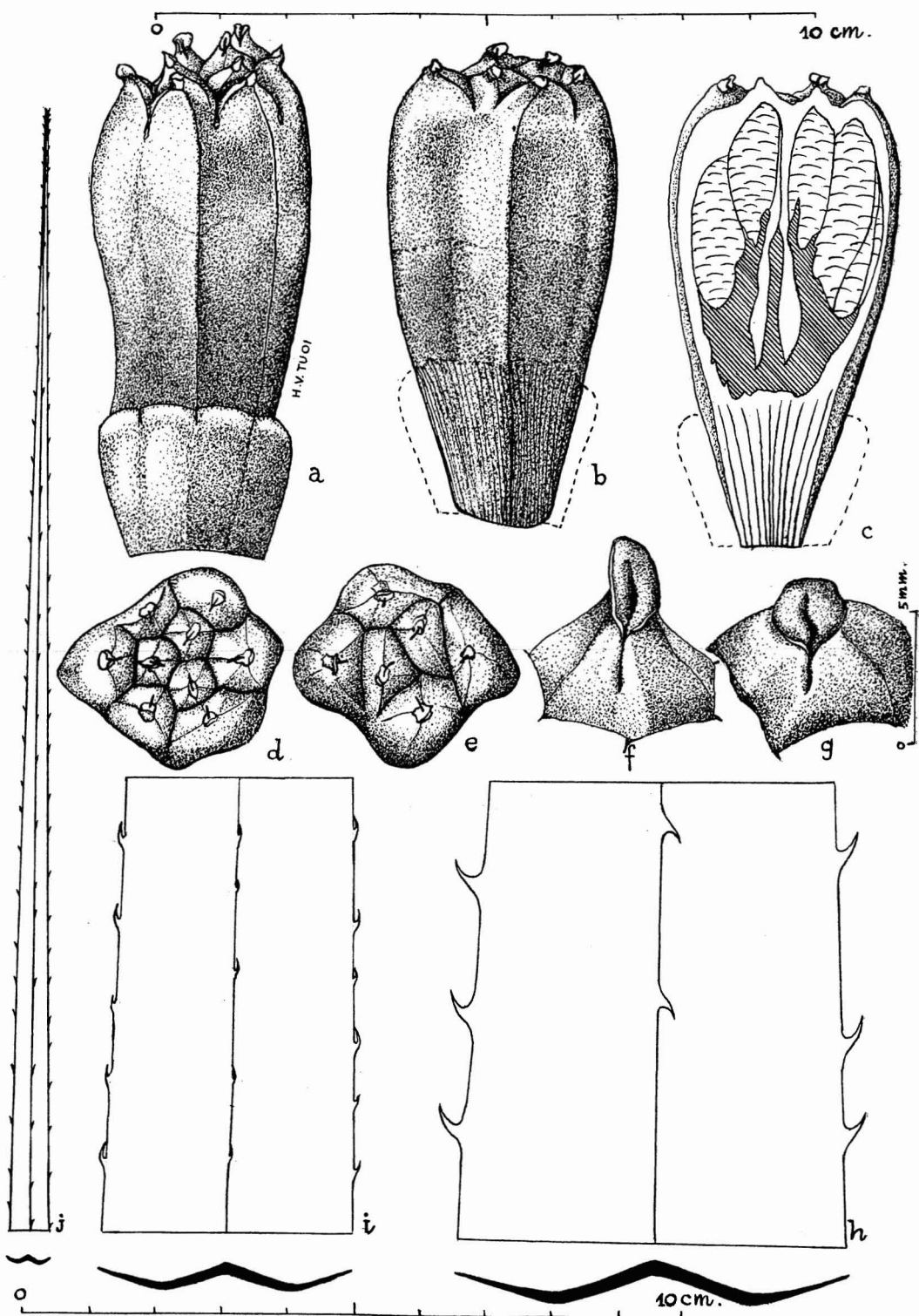


FIG. 158. *Pandanus carnosus* St. John, from holotype. *a*, Fresh lateral phalange, lateral view, $\times 1$; *b*, dried subbasal phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, lateral phalange, apical view, $\times 1$; *e*, subbasal phalange, apical view, $\times 1$; *f*, apex of carpel in lateral phalange, oblique view, $\times 4$; *g*, apex of carpel in subbasal phalange, oblique view, $\times 4$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

lateral view of a phalange, nothing more. Since the genus existed, this was valid publication. Brongniart reviewed the *Pandanus* specimens collected by Gaudichaud and documented them as far as possible (Ann. Sci. Nat. Bot. VI, 1: 290, 1875). For this species he postulated that it came from Ile de la Réunion. However, in the recent detailed revision of the Mascarene species (Linn. Soc. Lond. Bot. Jour. 55: 1-32, 1953) Vaughan and Wiehe found no local species to match it.

It is of interest, then, to note that the recent collection from Singapore, *Fosberg* 36,919, is a perfect match for Gaudichaud's illustration of *P. Boryi*. This collection consists of one phalange and one leaf minus the tip, so it is scarcely more adequate than the Gaudichaud collection. Since it is a perfect match for the Gaudichaud figure, we offer here a description of this phalange and leaf as a standard description to supplement the minimal publication by Gaudichaud. In the Singapore herbarium there are also two collections from Singapore that fall into this same species. One has six phalanges and two leaves minus the tips; the other had a branch, many leaf bases, peduncle, core of the syncarp, and eight phalanges. Together they contribute to our knowledge of the population. No one of them furnishes all the details, but of all, the *Fosberg* 36,919 seems best to take as a standard.

The vessel "La Bonite," on which Charles Gaudichaud was the botanist, circumnavigated the globe in 1836 and 1837, and stopped at Singapore. *Pandanus* is still fairly common on Singapore Island and occurs there in several species. One of the tidal estuaries not far from the harbor is Sungei Pandan, and the general vernacular name of the genus in Malayan is "pandan." This was the source of our generic name, *Pandanus*, latinized and first published by Rumphius, later adopted and made valid by Stickman.

Pandanus carnosus sp. nov. (sect. *Pandanus*)

Fig. 158

DIAGNOSIS HOLOTYPE: Arbor 10 m alta 15 cm diametro, cortice pallide brunneo sparse muricato, radicibus fulturosis 1-2 m longis 3-3.5 cm diametro pallide brunneis in lineis muriculatis, foliis 1.8-2.4 m longis 5-5.2 cm latis supra olivaceo-viridibus et subglaucis infra pallide vir-

idibus coriaceis cum midnervo forti et in centro late sulcatis in sectione mediali cum 45 nervis parallelis secundariis in quoque dimidio nervis tertialis nullis laminis gladiformatis cum apicibus 15-30 cm longis subulatis trigonis eo 10 cm ex apice 0.9-1.3 mm lato basi amplexicaule et inermi sed ex 10 cm marginibus cum spinis 5-6.5 mm longis 11-30 mm separatis valide subulatis arcuatis adscendentibus pallidis, midnervo infra ex 22 cm cum spinis 6 mm longis 15-35 mm separatis simulantibus sed reflexis, in sectione mediali marginibus cum aculeis 3.5-4 mm longis 11-18 mm separatis subulatis valde adpresse adscendentibus apicibus rubris, midnervo infra cum aculeis 3 mm longis 15-25 mm separatis simulantibus adscendentibus, in apice subulato marginibus et midnervo infra cum subulato-serris 0.5-0.8 mm longis 2-11 mm separatis, syncarpio solitario terminali 18 cm longo 15 cm diametro subgloboso cum phalangibus numerosis eis 6.7-7.3 cm longis 2.7-3.5 cm latis 2.4-3.1 cm crassis apice in parte viridi in parte rubro-aurantiaco 5-6-anguloso, parte $\frac{2}{3}$ supra libera oblongo-elliptica vel oblongo-obovoideo apice depresso-convexo lateribus subcurvatis rugulosis sed sublucidis, suturis laterilibus nullis, sinibus centralibus apicalibus 4.5-5.5 mm profundis et V-formatis in apicibus anguste conicis (sed in phalangibus paucis probaliter eis subbasalibus apicibus demissiter pyramidalibus sinibus 2-3.5 mm profundis), carpelibus 6-10 apicibus plerumque anguste conicis eis marginalibus $\frac{1}{3}$ latioribus asymmetricalibus et plus minusve distaliter compressis erectis vel subdivergentibus, parte $\frac{1}{3}$ infera phalangis carnosio-incrassata 3-4 mm et deinde 25-35 mm diametro, stigmatibus 3-3.5 mm longis ellipticis sulcatis brunneis papillois, sinibus proximalibus $\frac{1}{3}$ - $\frac{1}{2}$ ad fondam extensis, endocarpio mediali 2.5-3 cm longo mahogani-brunneo osseoso solido lateribus 3-4 mm crassis intra lucidis, seminibus 13-18 mm longis 4.5 mm diametro fusiformibus, mesocarpio supero in apice carpeli quique cavernam formanti eis lateralibus 2.5 cm longis cum membranibus albis medullosis, mesocarpio basali fibroso et carnosio.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Tree 10 m tall, 15 cm in diameter; bark light brown, sparsely muricate; prop roots 1-2 m long, 3-3.5 cm in diameter, pale brown, muricu-

late in longitudinal lines; leaves 1.8–2.4 m long, 4.4–5.2 cm wide, above olive green and somewhat glaucous, below paler green, coriaceous, with a strong midrib and above it broadly channeled, at midsection with 45 secondary parallel veins in each half, no visible tertiary cross veins, sword-shaped, gradually tapering to the 15–30 cm subulate trigonous apex, this 10 cm down 0.9–1.3 mm wide, the base amplexicaul and unarmed, but beginning at 10 cm the margins with spines 5–6.5 mm long, 11–30 mm apart, stout subulate, arcuate ascending, pale; the midrib below beginning at 22 cm with spines 6 mm long, 15–35 mm apart, similar but reflexed; at midsection the margins with prickles 3.5–4 mm long, 11–18 mm apart, subulate, closely appressed ascending, reddish-tipped; the midrib below with similar ascending prickles 3 mm long, 15–25 mm apart; on the subulate apex the margins and midrib below with subulate-serreae 0.5–0.8 mm long, 2–11 mm apart; syncarp single, terminal, 18 cm long, 15 cm in diameter, subglobose, bearing numerous phalanges, these 6.7–7.3 cm long, 2.7–3.5 cm wide, 2.4–3.1 cm thick, the apex partly green, the remainder red-orange, 5–6-angled, the upper $\frac{2}{3}$ free, oblong-elliptic or oblong-obovoid, the apex low convex, the sides gently curved, rugulose but even so somewhat shining, lateral sutures none; central apical sinuses 4.5–5.5 mm deep and V-shaped when with narrowly conic apices (but on the occasional phalange, probably a subbasal one, with low pyramidal apices, the sinuses only 2–3.5 mm deep); carpels 6–10, the apices usually narrowly conic, the outer ones of the same thickness but about $\frac{1}{3}$ wider, asymmetric and more or less flattened distally, erect or slightly outwardly curved; the lower $\frac{1}{3}$ of phalange fleshy distended with shoulders distended to 3–4 mm all around, thus 25–35 mm in diameter; stigmas 3–3.5 mm long, elliptic, creased, brown, papillose; proximal sinus running $\frac{1}{3}$ – $\frac{1}{2}$ way to valley bottom; endocarp median, 2.5–3 cm long, dull mahogany-brown, bony, massive, the lateral walls 3–4 mm thick, the inner surfaces shining; seeds 13–18 mm long, 4.5 mm in diameter, fusiform; upper mesocarp forming in each carpel apex a cavern, the lateral ones 2.5 cm long, filled with the white membranes of an aerenchyma; basal mesocarp fibrous and fleshy.

HOLOTYPE: Singapore, Kranji village, cut-over thicket near house, 2 m. alt., July 10, 1960, *H. St. John* 26,375 (BISH).

SPECIMENS EXAMINED: Malaya, Pahang, Telok Sisik, Kuantan, near the sea, 4 Dec. 1924, *I. H. Burkill & Md. Haniff* 17,346 (SING).

DISCUSSION: *P. carnosus* is a member of the section *Pandanus*. It is one of the curious Asiatic species with fleshy, enlarged bases of the phalanges. None of the described species are close relatives, but it is related to an undescribed one from Okinawa, represented by the collection *St. John* 25,950.

The new epithet is the Latin adjective *carnosus*, fleshy, in allusion to the fleshy base of the phalange.

Pandanus globosus sp. nov. (sect. *Pandanus*)

Fig. 159

DIAGNOSIS HOLOTYPE: Arbor ? ramis 3 cm diametro brunneis rugosis, foliis 81–90 cm longis 3.5 cm latis supra viridibus infra pallidioribus et apparente glaucis late sulcatis coriaceis in sectione mediali cum 38 nervis parallelis secundariis in quoque medio nervis tertialis nullis laminis gladiformatis sensim in apice 20 cm longo subulato trigono diminuentibus eo 10 cm ex apice 2 mm lato basi amplexicauli inermi sed ex 5 cm marginibus cum aculeis 3.5–5 mm longis 5–12 mm separatis arcuatis subulatis adscendentibus apicibus brunneis, midnervo infra ex 5 cm cum aculeis 2–3 mm longis 6–18 mm separatis simulantibus sed reflexis, in sectione mediali marginibus cum aculeis 2.8–3 mm longis 5–12 mm separatis subulatis valde adpressis adscendentibus, midnervo infra cum aculeis 0.8–1 mm longis 5–12 mm separatis subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum aculeis 0.5–0.8 mm longis 4–8 mm separatis subulatis adpresse adscendentibus, inflorescentia foeminea terminali cum syncarpio solitario, pedunculo 9 cm longo 8 mm diametro trigono folioso-bracteato, syncarpio 8.8 cm diametro globoso cum 26 phalangibus eis 3.6–3.9 cm longis 2.5–2.8 cm latis 2.2–2.5 cm crassis breviter crasse pyriformatis 6-angulosis lateribus planis vel subcurvatis laevibus lucidis in sicco pallide brunneis parte $\frac{2}{3}$ supera libera apice depresso convexo, suturis lateralibus nullis, sinibus apicalibus centralibus 2–3.5 mm pro-

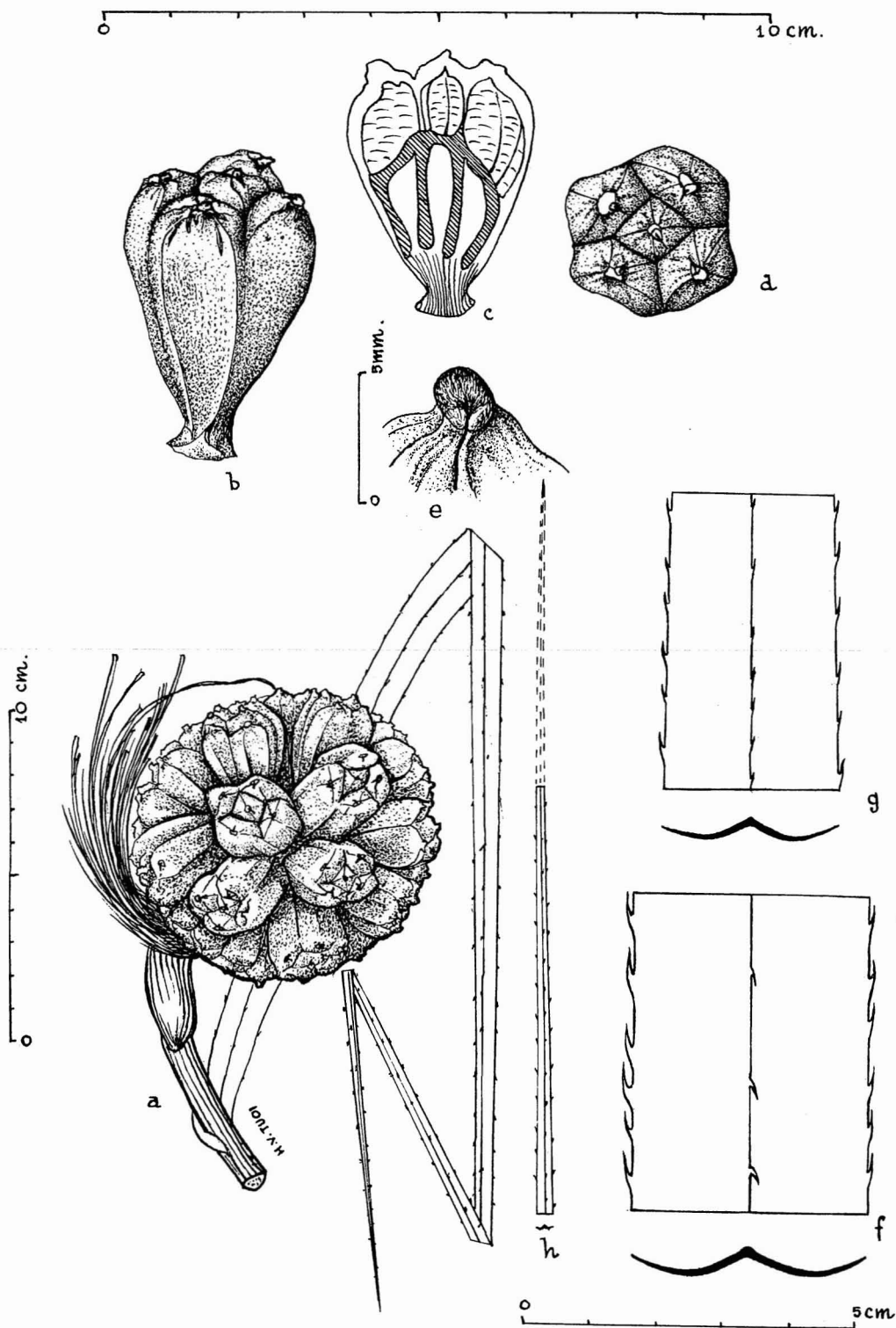


FIG. 159. *Pandanus globosus* St. John, from holotype. *a*, Syncarp, $\times \frac{1}{2}$; *b*, phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, phalange, apical view, $\times 1$; *e*, carpel apex, stigma, and proximal sinus, oblique view, $\times 4$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

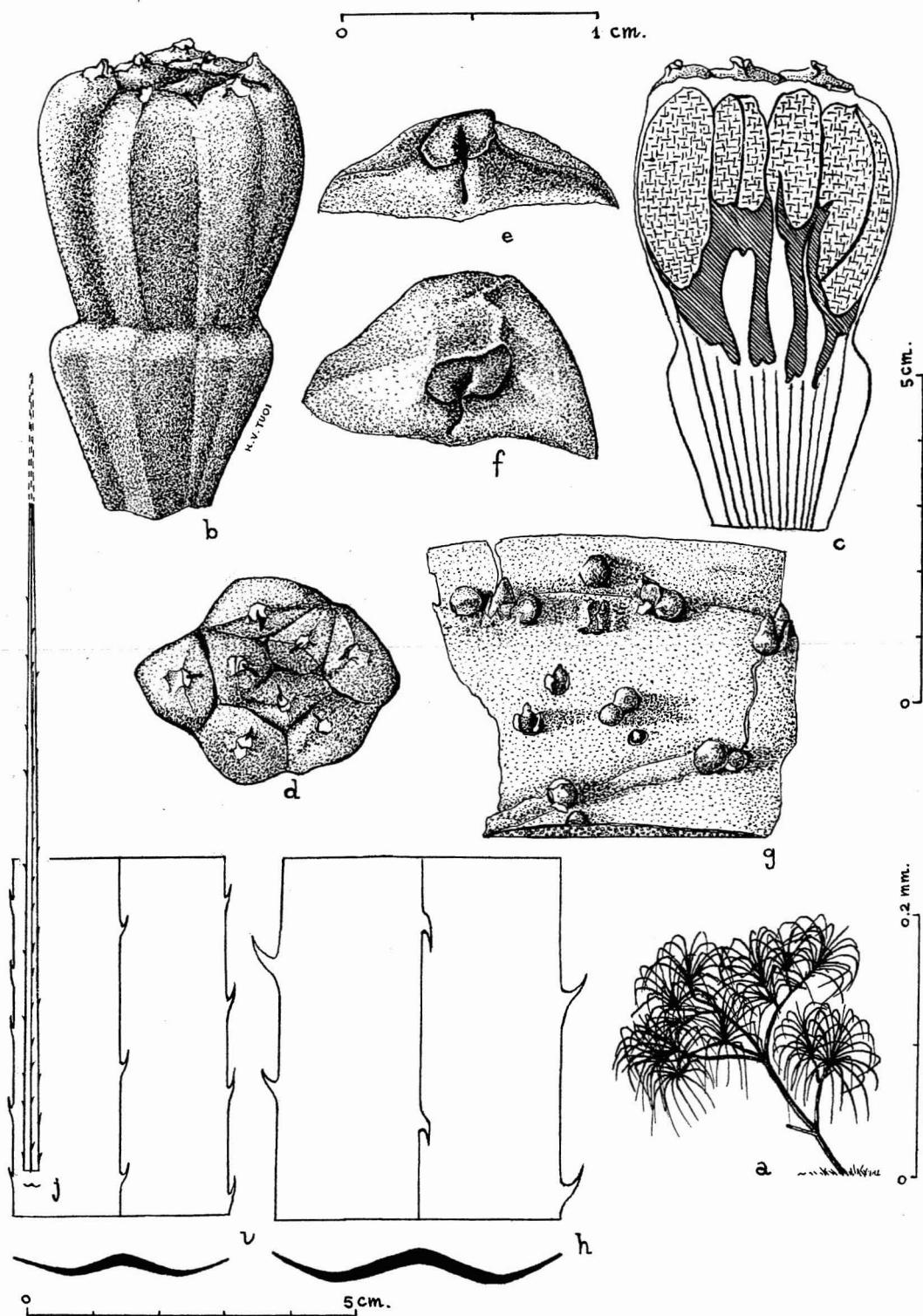


FIG. 160. *Pandanus inclinatus* St. John, from holotype. *a*, Habit, $\times 1/200$; *b*, phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, phalange, apical view, $\times 1$; *e*, *f*, carpel apices, stigmas, and proximal sinuses, oblique view, $\times 4$; *g*, bark with adventitious rootlets, $\times 1$.

fundis late V-formatis rectis vel subcurvatis, carpelibus 5-6 apicibus conicis angulatis basi rotundato apice rugoso eis centralibus quando sunt minoribus, stigmatibus 2.5-3 mm longis cordato-orbicularibus vel ellipticis brunneis papillois prominentibus obliquis centripetalibus, sinibus proximalibus $\frac{1}{2}$ - $\frac{2}{3}$ ad fundam extentis, endocarpio minime submediali brunneo osseoso lateribus 1.5-2 mm crassis intra obscure brunneis lucidis, seminibus 10-14 mm longis 3.5-4 mm diametro ellipsoideis vel obliquiter ellipsoideis, mesocarpio supero in apice quaque carpellae cavernam cum fibris paucis et membranarum pallidis medullosis formanti, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Apparently tree-like; branch 3 cm in diameter, brown, roughened by crowded leaf scars; leaves 81-90 cm long, 3.5 cm wide, green above, below paler green and apparently glaucous, with a broad V-shaped furrow above the midrib, coriaceous, at midsection with 38 secondary veins in each half, no visible tertiary cross veins, sword-shaped, tapering gradually to the 20 cm subulate, trigonous apex, this 10 cm down 2 mm wide, the base amplexicaul, unarmed, but beginning 5 cm up the margins with prickles 3.5-5 mm long, 5-12 mm apart, arcuate subulate, fully ascending, brown-tipped; the midrib below beginning at 5 cm with prickles 2-3 mm long, 6-18 mm apart, similar but reflexed; at midsection the margins with prickles 2.8-3 mm long, 5-12 mm apart, subulate, flat appressed, ascending; the midrib below with prickles 0.8-1 mm long, 5-12 mm apart, subulate, ascending; on the subulate tip the margins and midrib below with subulate, appressed ascending prickles 0.5-0.8 mm long, 4-8 mm apart; pistillate inflorescence terminal, bearing one syncarp; peduncle 9 cm long, 8 mm in diameter, 3-sided, leafy bracted; syncarp 8.8 cm in diameter, globose, bearing about 26 phalanges, these 3.6-3.9 cm long, 2.5-2.8 cm wide, 2.2-2.5 cm thick, short, thick pyriform, 6-angled, the sides plane or gently curved, smooth, shining, when dried light brown, upper $\frac{2}{3}$ free, the apex low convex; lateral sutures none; central apical sinuses 2-3.5 mm deep, wide V-shaped, straight or gently curved; carpels 5-6, the apices with a rounded base and conic, angled, wrinkled tip, the central ones, when present, slightly

the smaller; stigmas 2.5-3 mm long, cordate-orbicular to -elliptic, brown, papillose, prominent, oblique, centripetal; proximal sinus running $\frac{1}{2}$ - $\frac{2}{3}$ way to valley bottom; endocarp slightly inframedian, brown, bony, the lateral walls 1.5-2 mm thick, the inner surfaces polished, dark brown; seeds 10-14 mm long, 3.5-4 mm in diameter, ellipsoid or obliquely so; upper mesocarp forming in the apex of each carpel a cavern with a few fibers and with pale, medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Malaya, Kedah, w. coast, P. Dayang Banting, P[ulau] Langkawi, sea level, on limestone, 27 Nov. 1934, M. R. Henderson 29,153 (SING).

SPECIMENS EXAMINED: Borneo: Karimata groep, Poelau, Karimata, 23/3/1931, *Mondi* 155 (BO).

Celebes: Kota Menado, strand, 31/XII/1894, *Koorders* 18,462 (BO).

DISCUSSION: *P. globosus* is a member of the section *Pandanus*, as is its closest relative, the Vietnamese species *P. subulatus* St. John, a species which has the syncarp suborbicular-ellipsoid, 10-10.5 cm in diameter; carpel apices pyramidal or oblate-pyramidal; stigmas 1.5-2 mm long, black; endocarp supramedian; the leaf apex at the point 10 cm down 3.5 mm wide; the margins near the base with spines 5-6 mm long, ascending at 45°; *P. globosus* has the syncarp globose, 8.8 cm in diameter; carpel apices low convex; stigmas 2.5-3 mm long, brown; endocarp inframedian; leaf apex at the point 10 cm down 2 mm wide; the margins near the base with prickles 3.5-5 mm long, fully ascending.

The new epithet is the Latin adjective *globosus*, spherical, and is given in reference to the spherical head of fruits.

Pandanus inclinatus sp. nov. (sect. *Pandanus*)

Figs. 160, 170c

DIAGNOSIS HOLOTYPI: Arbor 8 m alta 13 cm diametro, cortice pallide brunneo muricato et cum radicillis adventivis adpresse adscendentibus ad 1 cm longis, radicibus futuosis nullis, foliis 1.5-1.7 m longis 4.4-4.7 cm latis coriaceis supra obscure olivaceo-viridibus infra viridibus spinis omnibus albis cum apicibus brunneis lamina 1-sulcatis et lateribus semirevolutis in sectione

mediali cum 38–40 nervis parallelis secundariis in quoque dimidio, nervis tertialis nullis, lamina gladiformi in apice caudato trigono subulato 15–20 cm longo diminuenti eo 10 cm ex apice 1 mm lato, basi amplexicauli et inermi sed ex 3–7 cm marginibus cum aculeis 3.5–6 mm longis 10–30 mm separatis crassiter subulatis subarcuatis adscendentibus, midnervo infra ex 7–8 cm cum aculeis 3–5 mm longis 20–50 mm separatis crassiter subulatis valde reflexis, in sectione mediali marginibus cum aculeis 3–3.5 mm longis 7–17 mm separatis crassiter subulatis adscendentibus valde adpressis, midnervo infra cum aculeis 2.5–3 mm longis 8–23 mm separatis subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum subulato-serrulis 0.5–1 mm longis 5–10 mm separatis vel in oculis nullis, inflorescentia foeminea terminali cum syncarpio uno, pedunculo 30 cm longo 13–15 mm diametro trigono folioso-bracteato, syncarpio 16–23 cm longo 13–20 cm diametro cum 44–61 phalangiis eis 6–6.8 cm longis, dimidio supero 3.2–4.3 cm lato 2.3–3.7 cm crasso oblongo-obovoido truncato vel subtruncato aurantiaco-rubro apice subviridi 5–7-anguloso lateribus subcurvatis vel subplanis laevibus et lucidis, suturis lateralibus nullis, sinibus centralibus apicalibus 0.7–2 mm profundis rectis vel subcurvatis, dimidia infera phalangis turbinata carnosa humeris carnosus 3–6 mm latis carne subsucrato comesto aurantiaco-rubro, carpelibus 6–12 plerumque 7–9 (sed in gemine 18 et phalangio 5.5 cm lato 4.4 cm crasso) interioribus paene minoribus, apicibus planatis sed paucae oblato-pyramidalibus, stigmatibus 2–3 mm longis ellipticis vel late ellipticis obliquis brunneis sulcatis pluribus marginalium truncatis ex plano oblique et cum concavitate parvo distali, sinibus proximalibus profundis $\frac{1}{2}$ – $\frac{2}{3}$ ad fondam extensis, endocarpio 3 cm longo mediali osseoso obscure mahogany-colorato intra lucido lateribus 2.5 mm crassis, seminibus 14–17 mm longis 4–5.5 mm diametro ellipsoideo, mesocarpio supero in quoque carpelo cavernam cum fibris paucis et aerenchyma cum membranis albis formanti, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Tree, 8 m tall, 13 cm in diameter; bark light brown, muricate, and with a few appressed ascending rootlets up to 1 cm in length; prop roots none; leaves 1.5–

1.7 m long, 4.4–4.7 cm wide, coriaceous, above dark olive green, below green, the spines all white with minute brown tips, blade broad furrowed above the midrib, the sides down curved, at midsection with 38–40 secondary parallel veins in each half, no tertiary cross veins, sword-shaped, tapering upwards into a 15–20 cm subulate, trigonous, caudate apex, this 10 cm down 1 mm wide, the base amplexicaul and unarmed, but starting at 3–7 cm up the margins with prickles 3.5–6 mm long, 10–30 mm apart, stout subulate, slightly arcuate, ascending; the midrib below beginning at 7–8 cm with prickles 3–5 mm long, 20–50 mm apart, stout subulate, sharply reflexed; at midsection the margins with prickles 3–3.5 mm long, 7–17 mm apart, stout subulate, ascending, closely appressed; the midrib below with prickles 2.5–3 mm long, 8–23 mm apart, subulate, ascending; on the subulate apex the margins and midrib below with subulate serrulations 0.5–1 mm long, 5–10 mm apart or even lacking for distances on the margins; pistillate inflorescence terminal, bearing one syncarp; peduncle 30 cm long, 13–15 mm in diameter, 3-sided, leafy bracted; syncarp 16–23 cm long, 13–20 cm in diameter, bearing 44–61 phalanges, these 6–6.8 cm long, the upper half 3.2–4.3 cm wide, 2.3–3.7 cm thick, oblong-obovoid, truncate or subtruncate, orange-red, the color becoming paler upwards to the partly greenish apex, 5–7-angled, the sides gently curved or almost plane, smooth and shining; lateral sutures none; central apical sinuses 0.7–2 mm deep, the bottom straight or gently curved, V-shaped, then immediately wide flaring; lower half of phalange turbinata above the truncate base, fleshy enlarged, the shoulders 3–6 mm wide, the flesh slightly sweet, nonirritating, orange-red; carpels 6–12, mostly 7–9 (but in a double 18 and this one 5.5 cm wide, 4.4 cm thick), the central ones only slightly the smaller, the apices flattened but perceptibly oblato pyramidal; stigmas 2–3 mm long, elliptic or broadly so, oblique, brown, creased, many of the marginal ones truncate by the visor-like edge of a distal oblique plane terminating in a small concavity; proximal sinus deep, running $\frac{1}{2}$ – $\frac{2}{3}$ way to valley bottom; endocarp median, 3 cm long, bony, dark mahogany-colored, the inner surfaces shining, the lateral wall 2.5 mm thick; seeds

14–17 mm long, 4–5.5 mm in diameter, ellipsoid; upper mesocarp forming in the apex of each carpel a cavern with a few fibers and an aerenchyma of white medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Singapore, Kranji Nature Reserve, brackish swamp with *Sonneratia caseolaris*, *Hibiscus tiliaceus*, *Acrostichum aureum*, July 10, 1960, *H. St. John* 26,378 (BISH).

DISCUSSION: *P. inclinatus* is a member of the section *Pandanus*, as is its closest relative, *P. vietnamensis* St. John, of Vietnam, a species with the syncarp 27 cm long, with 106 phalanges, these 5.8–6 cm long, the apex low convex; stigma 3.5–5 mm long or wide, black; leaves 0.99–1.49 m long, 5–6 cm wide, the margin near the base with spines 4–11 mm long, the nearby midrib below with spines 6–8 mm long. *P. inclinatus* has the syncarp 16–23 cm long, with 44–61 phalanges, these 6–6.8 cm long, the apex truncate or subtruncate; stigmas 2–3 mm long, brown; leaves 1.5–1.7 m long, 4.4–4.7 cm wide, the margin near the base with prickles 3.5–6 mm long, and the nearby midrib below with prickles 3–5 mm long.

The new epithet is the Latin participle *inclinatus*, inclined, given in reference to the oblique stigmas.

***Pandanus incrassatus* sp. nov. (sect. *Pandanus*)**

Figs. 161, 171

DIAGNOSIS HOLOTYPE: Arbor 7–8 m alta 8–10 cm diametro, cortice griseo remote muricato in ramis vetustioribus et trunco cum radicillis adventivis paucis adpresse adscendentibus, radicibus fulturosis 5–10 dm longis 10–13 mm diametro pallide brunneis cum radicillis brevibus spiniformatis in lineis, foliis 1.45–1.7 m longis 4.2–4.3 cm latis coriaceis supra olivaceo-viridibus infra viridibus et glaucis spinis albis deinde apicibus brunneis, laminis 1-sulcatis et cum plicis duobus rotundatis in sectione mediali cum 34–35 nervis secundariis in quoque medio nervis tertialis nullis gladiformatis sensim in apice 30 cm longo subulato trigono diminuentibus eo 10 cm ex apice 1.1 mm lato, basi amplexicauli et inermi albo sed ex 7–9 cm marginibus cum spinis 3.5–5 mm longis 15–25 mm separatis arcuatis crassiter subulatis adscendentibus, midnervo infra ex 9–12 cm cum spinis

3–4 mm longis 20–28 mm separatis valide subulatis reflexis, in sectione mediali marginibus cum aculeis 2.5–3 mm longis 10–20 mm separatis arcuatis subulatis adpresse adscendentibus, midnervo infra cum aculeis 1.5–2 mm longis 12–20 mm separatis arcuatis subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum subulato-serrulis 0.5–0.7 mm longis 3–5 mm separatis, inflorescentia foeminea terminali cum syncarpio solitario pendenti, pedunculo 23 cm longo 1.5 cm diametro trigono folioso-bracteato, syncarpio 15 cm longo 14.5 cm diametro subglobooso cum 54 phalangibus eis 4.6–5.2 cm longis media supera 2.5–3.1 cm longa, 3–3.6 cm lata 2.3–3 cm crassa obovoidea plano-truncata viridi deinde rubro-aurantiaca 5–6-angulosa lateribus subcurvatis infra laevibus et lucidis supra rugulosis et sublucidis, suturis lateralibus nullis, sinibus apicalibus centralibus plerumque (et in phalangibus lateralibus apicalibusque omnibus) 1–2 mm profundis late V-formatis rectis vel subcurvatis (vel in phalangibus subbasalibus paucis 2–3 mm profundis), media infera phalangis carnosio-incrassata 2.8–3.6 cm lata 2.4–3.1 cm crassa, late cuneata supra aurantiaco-rubra infra pallidiori, humeris 2–5 mm latis undulatis carne saccharosa sed non consumpta, carpelis 5–8 centralibus $\frac{1}{2}$ – $\frac{2}{3}$ tam grandibus quam marginalibus, phalangibus dimidii superi cum apicibus carpeli subtruncatis vel oblatiori-pyramidalibus sed eis dimidii inferi cum apicibus oblato-pyramidalibus, stigmatibus 2–3 mm longis ellipsoideis obscure brunneis papillois sulcatis obliquis prominentibus centripetalibus eis marginalibus plerumque cum supra stigmatem galea distali cartilaginea, sinibus proximalibus $\frac{1}{2}$ – $\frac{2}{3}$ ad fondam extentis, endocarpio 2.5 cm longo mediali osseoso obscure brunneo intra lucido lateribus 2.5 mm crassis, seminibus 12 mm longis 4 mm diametro ellipsoideis, mesocarpio supero in apice quique carpeli cavernam cum membranis albis lucidis medullosis formanti, mesocarpio basali fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Tree 7–8 m tall, 8–10 cm in diameter; bark gray, remotely muricate, and the older trunk with a few appressed ascending adventitious rootlets; prop roots 5–10 dm long, 10–13 mm in diameter, light brown, with remote, short, spinelike rootlets in vertical

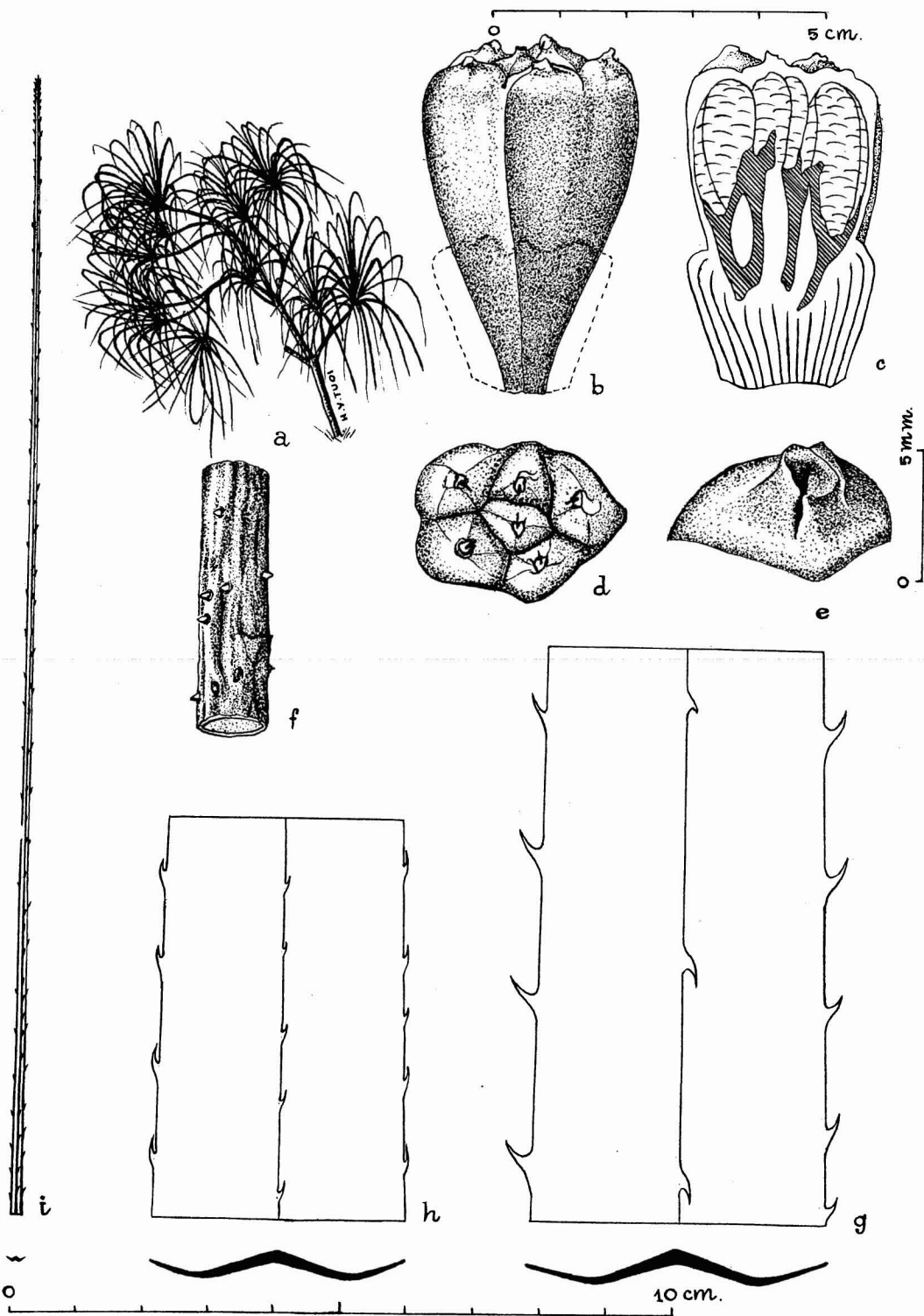


FIG. 161. *Pandanus incrassatus* St. John, from holotype. *a*, Habit, $\times 1/100$; *b*, dried phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, phalange, apical view, $\times 1$; *e*, carpel apex, stigma, and proximal sinus, oblique view, $\times 4$; *f*, prop root with spinelike rootlets, $\times 1$; *g*, leaf base, lower side, $\times 1$; *h*, leaf middle, lower side, $\times 1$; *i*, leaf apex, lower side, $\times 1$.

rows; leaves 1.45–1.7 m long, 4.2–4.3 cm wide, coriaceous, above olive green, below green and glaucous, the spines white, becoming brown-tipped, 1-ribbed and with two rounded pleats, at midsection with 34–35 secondary parallel veins in each half, no visible tertiary cross veins, sword-shaped, long tapering to a 30 cm subulate, trigonous apex, this 10 cm down 1.1 mm wide, the base amplexicaul and unarmed, white, beginning at 7–9 cm the margins with spines 3.5–5 mm long, 15–25 mm apart, arcuate, heavy subulate, ascending; the midrib below beginning at 9–12 cm with spines 3–4 mm long, 20–28 mm apart, stout subulate, reflexed; at midsection the margins with prickles 2.5–3 mm long, 10–20 mm apart, arcuate subulate, appressed ascending; the midrib below with prickles 1.5–2 mm long, 12–20 mm apart, arcuate subulate, ascending; near the apex the margins and midrib below with subulate serrulations 0.5–0.7 mm long, 3–5 mm apart; pistillate inflorescence terminal, bearing 1 pendent syncarp; peduncle 23 cm long, 1.5 cm in diameter, 3-sided, leafy-bracted; syncarp 15 cm long, 14.5 cm in diameter, subglobose, bearing 54 phalanges, these 4.6–5.2 cm long, the upper half 2.5–3.1 cm long, 3–3.6 cm wide, 2.3–3 cm thick, obovoid, flat truncate, green, turning red-orange, the shade deepening downwards, 5–6-angled, the sides gently curving, below smooth and shining, above rugulose and less shiny; lateral sutures none; central apical sinuses mostly (that is, for the lateral and apical phalanges) 1–2 mm deep, wide V-shaped, straight or gently curving (on a few subbasal ones 2–3 mm deep); lower half of phalange fleshy enlarged, 2.8–3.6 cm wide, 2.4–3.1 cm thick, wide cuneate, vermilion above, gradually paling below, the shoulders 2–5 mm wide, scalloped; pulp sweetish, innocuous, but not eaten; carpels 5–8, the central 1–2 being $\frac{1}{2}$ – $\frac{2}{3}$ the size of the marginal ones; on the phalanges of the upper half the carpel apices subtruncate or very oblate pyramidal, on those of the lower half the carpel apices oblate-pyramidal; stigmas 2–3 mm long, ellipsoid, dark brown, papillose, creased, oblique, prominent, centripetal, the marginal ones mostly with a distal, cartilaginous visor partly projecting over the stigma; proximal sinus running $\frac{1}{2}$ – $\frac{2}{3}$ way to valley bottom; endocarp median

2.5 cm long, bony, dark brown, the inner surfaces shining, the lateral walls 2.5 mm thick; seeds 12 mm long, 4 mm in diameter, ellipsoid; upper mesocarp forming a cavern in each carpel apex with white, shining, medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Singapore, Kranji Nature Reserve, mangrove swamp, with *Sonneratia caseolaris*, *Hibiscus tiliaceus*, *Acanthus ilicifolius*, near sea level, 7 July 1960, H. St. John 26,374 (BISH).

DISCUSSION: *P. incrassatus* is a member of the section *Pandanus*, as is its closest relative, the Vietnamese species *P. reversispiralis* St. John, a species with the syncarp oval-subglobose; phalanges 4.3–4.6 cm long, orange, the apex low convex; stigmas all terminal, exposed; leaves 70–130 cm long, 4.8–6 cm wide, slightly glaucous above, at midsection the margins with prickles 3–4 mm long. *P. incrassatus* has the syncarp subglobose; phalanges 4.6–5.2 cm long, red-orange, the apex truncate; marginal stigmas covered by a visor; leaves 145–170 cm long, 4.2–4.3 cm wide, olive green, not glaucous above, and at midsection the margins with prickles 2.5–3 mm long.

The new epithet is the Latin adjective *incrassatus*, thickened, and is given with allusion to the thickened base of the phalange.

Pandanus obtusus sp. nov. (sect. *Pandanus*)

Fig. 162

DIAGNOSIS HOLOTYPE: Arbor ? foliis 85–88 cm longis 3.4 cm latis coriaceis 1-sulcatis lateribus arcuatis in sectione mediali cum 37–39 nervis parallelis secundariis in quoque medio eis infra conspicuis, nervis tertialis nullis, laminis gladiformatis sensim in apice 15 cm longo subulato trigono diminuentibus eo 10 cm ex apice 2.5 mm lato, basi amplexicauli et inermis ex 5 cm marginibus cum aculeis 2.5–4 mm longis 8–14 mm separatis arcuatis subulatis pallidis in 45° adscendentibus, midnervo infra ex 8.5 cm cum aculeis 3.5–4 mm longis 12–20 mm separatis subulatis valde reflexis basibus crassiter conicis, in sectione mediali marginibus cum aculeis 3–3.5 mm longis 6–11 mm separatis arcuatis subulatis adscendentibus apicibus rubris, midnervo infra angusto salienti cum aculeis 1.5–2 mm longis 7–10 mm separatis arcu-

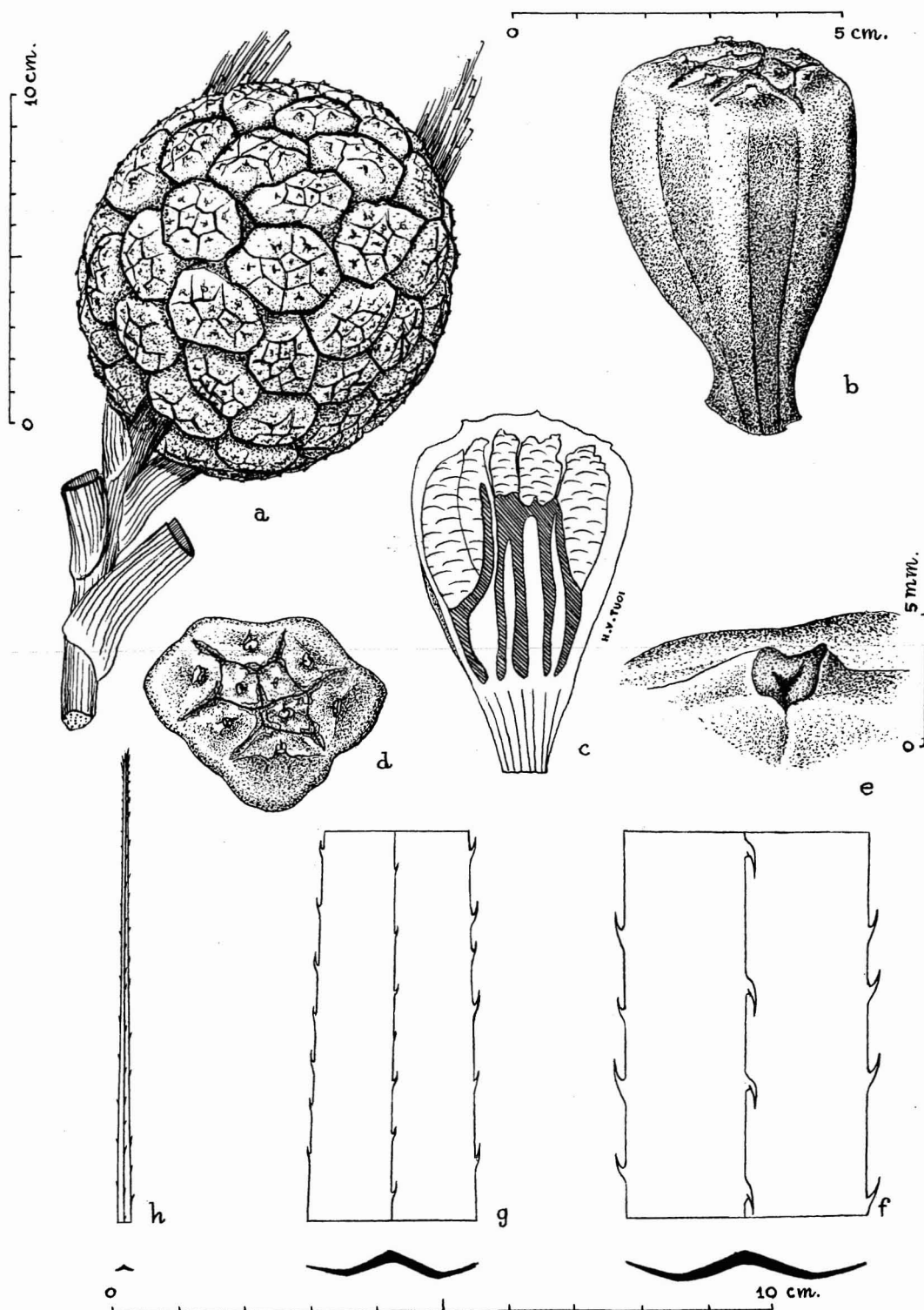


FIG. 162. *Pandanus obtusus* St. John, from holotype. *a*, Syncarp, $\times \frac{1}{2}$; *b*, phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, phalange, apical view, $\times 1$; *e*, carpel apex, stigma, and proximal sinus, oblique view, $\times 4$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

atis subulatis adscendentibus, in apice subulato marginibus et midnervo infra cum subulato-serrulis 0.3–0.7 mm longis 3–7 mm separatis, inflorescentia foeminea cum syncarpio unico terminali, pedunculo 23 cm et plus longo clavato in apice 11 mm diametro subtrigono, syncarpio globoso ? 12 cm diametro cum circa 38 phalangibus eis 5–5.5 cm longis 3–3.8 cm latis 2.7–3.3 cm crassis cuneatis 5–6-angulosis in sicco pallide brunneis lateribus laevibus lucidis subcurvatis vel subplanis parte $\frac{1}{3}$ supera libera apice convexo vel alte convexo suturis laterilibus nullis, sinibus centralibus apicalibus olim lineas brunneas, carpelis 8–10 apicibus rotundatis interioribus minoribus et $\frac{1}{2}$ tam grandibus quam marginalibus, stigmatibus 2–2.5 mm longis cordatis vel reniformibus obliquis centripetalibus, sinibus proximalibus brevibus $\frac{1}{3}$ – $\frac{1}{4}$ ad fondam extentis, endocarpio mediali 2.5–3 cm longo osseoso extra brunneo intra pallidi lateribus 2 mm crassis, seminibus 12 mm longis 3.5 mm diametro obliquiter ovoideis, mesocarpio supero in apice carpello quoque cavernam formanti eis lateralibus majoribus cum fibris longitudinalibus et membranis albis medullosis, mesocarpio basali fibroso et carnoso.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Probably treelike; leaves 85–130 cm long, 3.4 cm wide, coriaceous, furrowed above the midrib, the two halves gently arching, at midsection with 21–39 secondary parallel longitudinal veins in each half, these conspicuous below, no visible cross veins, blade swordlike, tapering upwards and gradually narrowed to a 15 cm subulate, trigonous apex which 10 cm down is 2.5 mm wide, the base amplexicaul and unarmed, but beginning at 5 cm the margins with prickles 2.5–4 mm long, 8–14 mm apart, arcuate subulate, pale, ascending at 45° ; the midrib below beginning at 8.5 cm with prickles 3.5–4.5 mm long, 12–20 mm apart, the base heavy conic, the rest subulate, fully reflexed; at midsection the margins with prickles 3–3.5 mm long, 6–11 mm apart, arcuate subulate, ascending, reddish-tipped; the midrib below narrow and salient, with prickles 1.5–2 mm long, 7–10 mm apart, arcuate subulate, ascending; on the subulate apex the margins and midrib below with subulate-tipped serrations 0.3–0.7 mm long, 3–7 mm apart; pistillate inflorescence

with a single, terminal syncarp; peduncle more than 23 cm in length, clavate and at apex 11 mm in diameter, somewhat 3-sided; syncarp apparently globose and 12 cm in diameter, and bearing about 38 phalanges, these 5–5.5 cm long, 3–3.8 cm wide, 2.7–3.3 cm thick, cuneiform, 5–6-angled, when dried pale brown, the sides smooth and shiny, gently curving or flat-tish, free in upper $\frac{1}{3}$, the apex convex or high convex, lateral sutures none, central apical sinuses mere brown lines on the obtuse apex; carpels 8–10, the apices rounded, not raised, the inner ones smaller, about $\frac{1}{2}$ the size of the marginal ones; stigmas 2–2.5 mm long, cordate to reniform, oblique, centripetal; proximal sinus a very short crack or hole by the stigma, running $\frac{1}{4}$ – $\frac{1}{3}$ way to the valley bottom; endocarp median, 2.5–3 cm long, bony, pale within, dark brown near the margins, the seed cavities shining, the lateral walls 2 mm thick; seeds 12 mm long, 3.5 mm in diameter, obliquely ovoid; upper mesocarp forming in the apex of each carpel a cavern, the lateral ones thrice the larger, with longitudinal fibers and white medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Malaya, Pahang, Beserah, Kuantan, sea level, 18 Aug. 1929, M. R. Henderson 22,746 (SING).

SPECIMENS EXAMINED: Singapore, 15 Feb. 1870, J. S. G[oodenough], (SING). This has leaves only 2 cm wide, and with 21 secondary veins on a side, but the phalanges seem identical.

DISCUSSION: *P. obtusus* is a member of the section *Pandanus*. In that section the most similar species seems to be a Marquesan one, *P. tectorius* Soland. var. *uapensis* F. Br., which has the phalanges 5.4–6 cm long, 4.5 cm wide, the apical and lateral sutures very shallow or superficial; apical central sinuses 1 mm deep; stigmas 3 mm long; endocarp suprmedian, but the leaves and syncarp are unknown. *P. obtusus* has the phalanges 5–5.5 cm long, 3–3.8 cm wide, the lateral sutures none, the apical central sinuses mere tessellate rulings; stigmas 2–2.5 mm long; and the endocarp median.

The new epithet is the Latin word *obtusus*, blunt or obtuse, and is given with reference to the obtuse phalange and carpel apices.

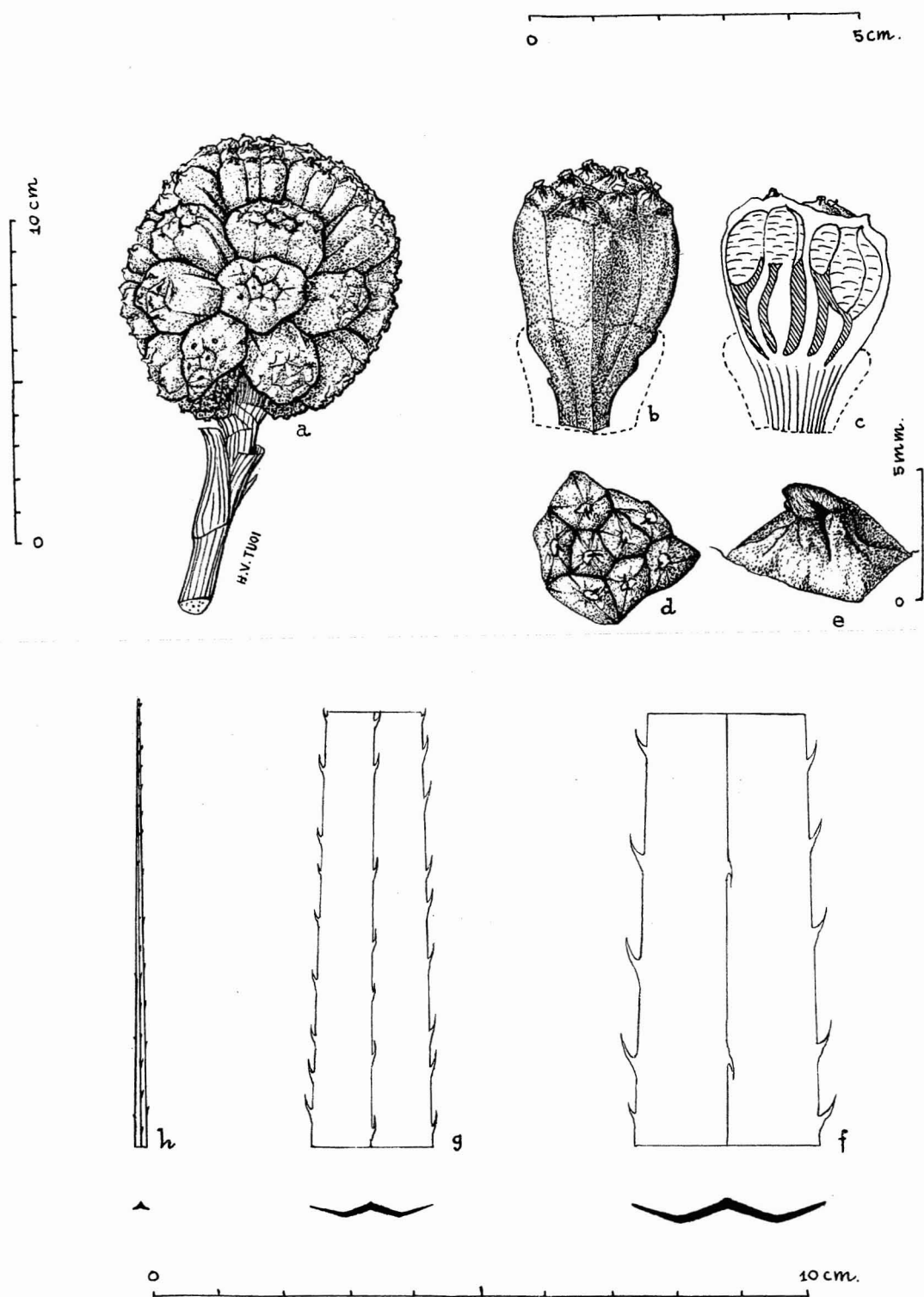


FIG. 163. *Pandanus rubricoloratus* St. John, from holotype. *a*, Syncarp, $\times \frac{1}{2}$; *b*, dried phalange, lateral view, $\times 1$; *c*, phalange, longitudinal median section, $\times 1$; *d*, phalange, apical view, $\times 1$; *e*, carpel apex, stigma, and proximal sinus, oblique view, $\times 4$; *f*, leaf base, lower side, $\times 1$; *g*, leaf middle, lower side, $\times 1$; *h*, leaf apex, lower side, $\times 1$.

Pandanus rubricoloratus sp. nov. (sect. *Pandanus*)

Fig. 163

DIAGNOSIS HOLOTYPE: Arboriformis 3–5 m alta, foliis 66–73 cm longis 2.8–3 cm latis coriaceis supra viridibus infra pallidioribus supra midnervum sulcatis in sectione mediali cum 27 nervis parallelis secundariis in quoque medio nervis tertialis nullis laminis gladiformatis in apice 12–15 cm longo subulato sensim diminuentibus eo 10 cm ex apice 4 mm lato basi amplexicauli et inermi sed ex 3–4 cm marginibus cum aculeis 2.5–5 mm longis 4–18 mm separatis subulatis pallidis adscendentibus, midnervo infra ex 8–10 cm cum aculeis 2.5–3 mm longis 16–30 mm separatis simulantibus sed adpresse reflexis, in sectione mediali marginibus cum aculeis 2–2.5 mm longis 4–12 mm separatis subulatis adscendentibus apicibus brunneis, midnervo infra cum aculeis simulantibus 1.5–2 mm longis 6–13 mm separatis; in apice subulato marginibus et midnervo infra cum subulato-serrulis 0.6–1 mm longis 2–6 mm separatis; inflorescentia foeminea terminali cum syncarpio solitario, pedunculo 15 cm et plus longo 8 mm diametro exclavatis trigono folioso-bracteato, syncarpio 9 cm longo 8.5 cm diametro globoso cum circa 34 phalangibus, eis 3.6 cm longis 2.4–2.7 cm latis 2–2.4 cm crassis rubris parte 5/9 supera libera, hac late ellipsoidea 5–6-angulosa apice depresso convexo lateribus subcurvatis laevibus suturis lateralibus nullis, sinibus apicalibus centralibus 0.5–2 mm profundis vadosis, carpelis 6–9 (in gemine 12 et phalangio 3.3 cm lato) apicibus depresso pyramidalibus angulatis rugosis (in phalangibus basalibus apicibus depresso convexis) parte 4/9 infera carnosio-incrassata, stigmatibus 2–3.5 mm latis cordatis griseis horizontalibus vel obliquis centripetalibus, sinibus proximalibus latis $\frac{1}{2}$ ad fondam extentis, endocarpio mediali 15 mm longo osseoso obscure brunneo lateribus 1.5 mm crassis intra papillosis et sublucidis, seminibus 8–11 mm longis obliquiter ellipsoideis, mesocarpio supero in apice quoque carpelo cavernam cum fibris paucis et membranis brunneis medullosis, mesocarpio basali fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Treelike, 3–5 m tall; leaves 66–73 cm long, 2.8–3 cm wide,

coriaceous, green above, paler beneath, furrowed above the strong midrib, the sides arching, at midsection with 27 parallel secondary veins in each half, no tertiary cross veins, blade sword-shaped, tapering upwards and gradually tapering to the 12–15 cm subulate apex which 10 cm down is 4 mm wide, the base amplexicaul and unarmed, but beginning 3–4 cm up the margins with prickles 2.5–5 mm long, 4–18 mm apart, subulate, ascending, pale; midrib below beginning at 8–10 cm with prickles 2.5–3 mm long, 16–30 mm apart, similar but reflexed, appressed; at midsection the margins with prickles 2–2.5 mm long, 4–12 mm apart, subulate, ascending, brown-tipped; the midrib below with similar prickles 1.5–2 mm long, 6–13 mm apart; on the subulate tip the margins and midrib below with subulate serrations 0.6–1 mm long, 2–6 mm apart; pistillate inflorescence terminal, bearing one syncarp; peduncle more than 15 cm long, 8 mm in diameter, not clavate, 3-sided, leafy bracted; syncarp 9 cm long, 8.5 cm in diameter, globose, bearing about 34 phalanges, these 3.6 cm long, 2.4–2.7 cm wide, 2–2.4 cm thick, red, upper 5/9 free, this part broadly ellipsoid, 5–6-angled, the apex low convex, the sides gently curved, smooth, lateral sutures none; central apical sinuses 0.5–2 mm deep, shallow; carpels 6–9 (in a double 12, and the phalange 3.3 cm wide), the apices low pyramidal, angled and wrinkled (on the basal phalanges the carpel apices low convex); lower 4/9 of phalange fleshy enlarged as shown by persistent shoulders; stigmas 2–3.5 mm wide, cordate, gray, horizontal or oblique, centripetal; proximal sinus wide, running $\frac{1}{2}$ way to valley bottom; endocarp median, 15 mm long, bony, blackish brown, the lateral walls 1.5 mm thick, the inner surfaces papillose, a little shiny; seeds 8–11 mm long, oblique ellipsoid; upper mesocarp forming in the apex of each carpel a cavern with a few fibers and an aerenchyma tissue of brownish medullary membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Malaya, Pahang, Pulau Tioman, Telok Paya, sea level, 19 May 1927, *M. R. Henderson* 18,444 (SING).

DISCUSSION: *P. rubricoloratus* is a member of the section *Pandanus*, as is its closest relative, the Vietnamese species *P. reversispiralis* St.

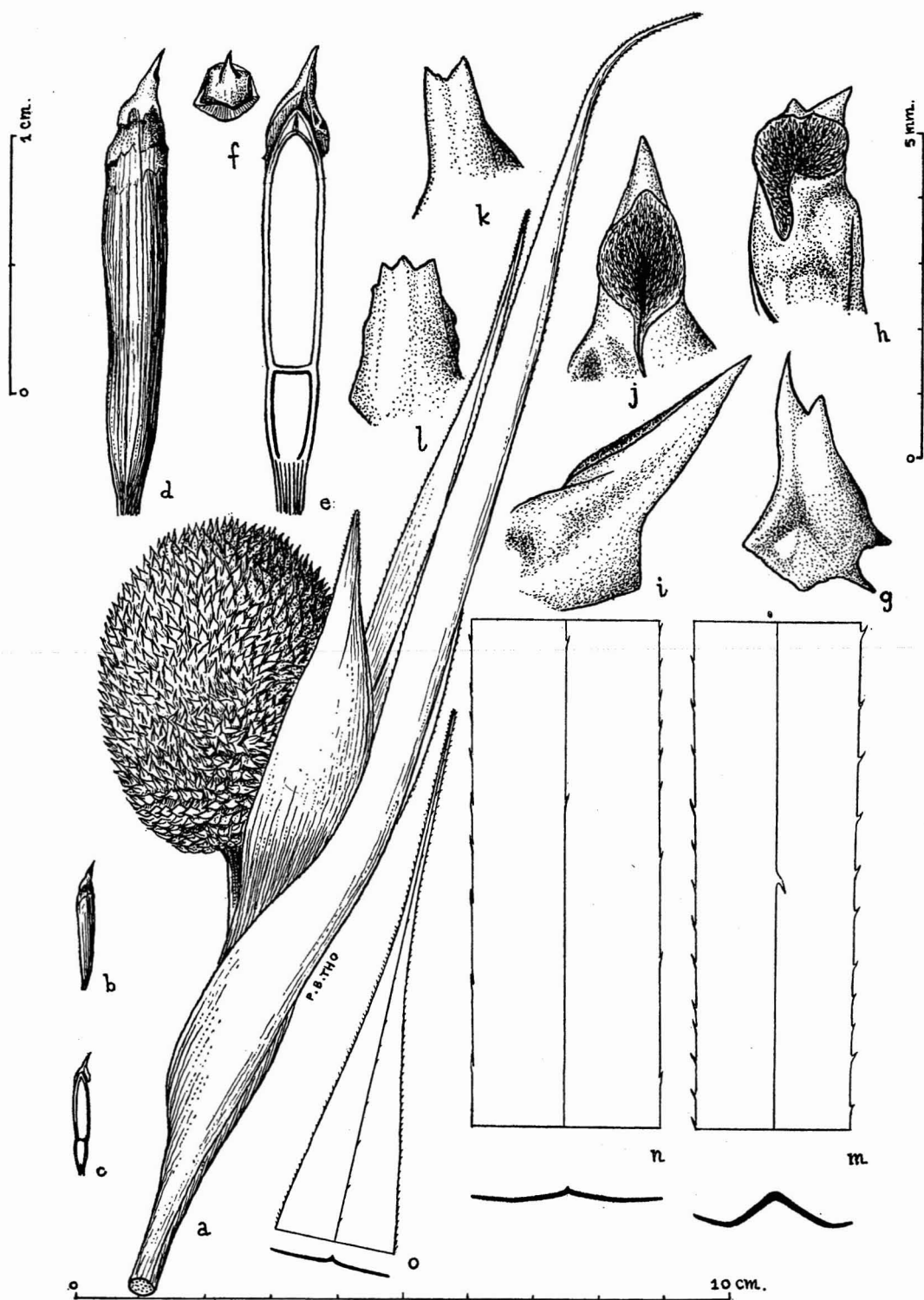


FIG. 164. *Pandanus brevicornutus* St. John, from holotype. *a*, Syncarp, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe apex and style, apical view, $\times 4$; *g*, style, distal view, $\times 10$; *h*, style and stigma, proximal view, $\times 10$; *i*, style and stigma, lateral view, $\times 10$; *j*, style and stigma, proximal view, $\times 10$; *k*, *l*, style, distal view, $\times 10$; *m*, leaf base, lower side, $\times 1$; *n*, leaf middle, lower side, $\times 1$; *o*, leaf apex, lower side, $\times 1$.

John, which has the syncarp 11–14 cm in diameter, oval-subglobose; phalanges 4.3–4.6 cm long, orange; central apical sinuses 3.5–5 mm deep; endocarp lateral walls 2–3 mm thick; and the leaves 4.8–6 cm wide, at midsection the margins with prickles 3–4 mm long, and 5–17 mm apart. *P. rubricoloratus* has the syncarp 8.5 cm in diameter, globose; phalanges 3.6 cm long, red; central apical sinuses 0.5–2 mm deep; endocarp lateral walls 1.5 mm thick; and the leaves 2.8–3 cm wide, at midsection the margins with prickles 2–2.5 mm long, and 4–12 mm apart.

The epithet is formed from the Latin words *ruber*, red; *coloratus*, colored, in reference to the red color of the fruit.

Pandanus brevicornutus sp. nov. (sect. *Rykia*)

Fig. 164

DIAGNOSIS HOLOTYPE: Frutex, ramis assurgentibus in apice 17 mm diametro luteis lucidis, foliis 41–47 cm longis 27–29 mm latis in medio sed in basi 18–22 mm latis ligulatis chartaceis proxima basem supra midnervum sulcatis alibi planis in sectione mediali cum 19–21 nervis parallelis secundariis in quoque medio nervis tertialis transversis semievidentis proxima apicem in apice 3.5 cm longo 1.5 mm lato trigono subulato semiabrupte diminuentibus, basi amplexicauli inermi sed ex 3–4 cm marginibus cum aculeis 1.5–3 mm longis 3–7 mm separatis subulatis adscendentibus obscure mahoganicoloratis lucidis, midnervo infra ex 9–10 cm cum aculeo unico 2.5 mm longo arcuato subulato reflexo, in sectione mediali marginibus cum aculeis 0.5–1.5 mm longis 6–11 mm separatis graciliter subulatis proxime adpressi-adscendentibus, midnervo infra cum aculeis 2–2.5 mm longis paucis remotis arcuatis subulatis reflexis vel adscendentibus, in apice subulato marginibus cum serrulis 0.2–0.5 mm longis 0.5–1.5 mm separatis, midnervo infra cum serrulis simulantibus 2–3 mm separatis, infructescencia cum syncarpio unico terminali erecto, pedunculo 10 cm longo 6 mm diametro cum folioso-bracteis multis, syncarpio 5.2 cm longo 4 cm diametro late ellipsoideo cum circa 960 drupis eis 16–18.5 mm longis 2–2.5 mm latis 1.5–2 mm crassis anguste cylindricis compressis 5-angulis corpore 14–15 mm longo, pileo 5–6 mm

longo basi 2 mm alta semiorbiculari, stylo 3–4 mm longo lanceolato osseoso brunneo lucido proxime curvato integro vel aliquis bifidis, stigmatate 1–1.5 mm longo elliptico vel late elliptico sulcato brunneo papilloso paene ad apicem extento, endocarpio in parte $\frac{1}{3}$ infera cartilagineo brunneo lateribus 0.1 mm crassis intra pallidis exlucidis, semine 3–4 mm longo ellipsoideo truncato, mesocarpio apicali cavernoso angusto ellipsoideo 9 mm longo, mesocarpio basali in lateribus fibroso intra carnosio 4–5 mm longo.

DESCRIPTION OF ALL SPECIMENS EXAMINED:

Shrub; branches assurgent, up to 1.3 m long, sprawling and forming a thicket, 17 mm in diameter at apex, yellowish, shining; leaves 35–50 cm long, 24–29 mm wide at the middle, 18–22 mm wide near the base, ligulate, chartaceous, yellowish green, not glaucous beneath, near the base sulcate over the midrib, elsewhere flat, at midsection with 18–21 secondary parallel nerves in each half, the tertiary cross veins barely visible only near the tip, near the tip rather abruptly tapering into a 3.5–7 cm subulate trigonous apex 1.5 mm wide, the base amplexicaul and cream-colored, unarmed, but beginning at 3–4 cm the margins with prickles 1.5–3 mm long, 3–7 mm apart, subulate, ascending, dark mahogany colored, shining; the midrib below 9–10 cm up with a prickle 2.5 mm long, arcuate subulate, reflexed; at midsection the margins with prickles 0.5–1.5 mm long, 6–11 mm apart, slender subulate, closely appressed ascending; the midrib below with a few remote prickles 2–2.5 mm long, arcuate subulate, reflexed or ascending; on the subulate apex the margins with serrulations 0.2–0.5 mm long, 0.5–1.5 mm apart; the midrib below with similar ones 2–3 mm apart; pistillate infructescence with a single, terminal, erect syncarp (rarely a smaller, lateral, secondary one, globose and 2 cm in diameter); peduncle 10–15 cm long, 4–6 mm in diameter, with numerous leafy bracts; syncarp 3.5–5.2 cm long, 3–4 cm in diameter, when young cream colored, broadly ellipsoid, bearing 600–960 drupes, these 16–18.5 mm long, 2–2.5 mm wide, 1.5–2 mm thick, narrowly cylindric, compressed, 5-angled, upper $\frac{1}{4}$ free, the body 14–15 mm long; pileus 5–6 mm long, the base 2 mm high, semiorbicular, crowned by a style 3–4 mm long, prolonged

into a lanceolate, entire or less commonly bifid beak, bony, brownish, shining, flattened, proximally curved; stigma 1–1.5 mm long, elliptic or broadly so, creased, brown, papillose, running almost to the apex; endocarp in lower $\frac{1}{3}$, cartilaginous, brown, walls 0.1 mm thick, the inner surface pale, dull; seed 3–4 mm long, ellipsoid, truncate; apical mesocarp a slender cavity 9 mm long; basal mesocarp fibrous up the sides, fleshy within, 4–5 mm long.

HOLOTYPE: Malaya, Johore, Sungei Kayu, in swamp, 17 Oct. 1936, *Kiah bin Haji Salleh* 32,102 (SING).

SPECIMENS EXAMINED: Malaya, [Sungei] Kayu, Mawai-Jemaluang Road, in swamp, evidently fruits common, 11 Oct. 1936, *E. J. H. Corner* 32,460 (SING), in large part, but not the loose fruit), (SING).

DISCUSSION: *P. brevicornutus* is a member of the section *Rykia*, as is its closest relative, the Malayan species *P. kedahensis* St. John, which has the syncarp 12.5 cm long, 11 cm in diameter; drupes 4.2–4.4 cm long, 8–13 mm wide, narrowly oblanceoloid; style 4–5 mm long, bifurcate, the lobes mostly divergent; endocarp with apical narrow pyramidal projection; seeds 15–16 mm long; leaves 4.5–4.6 cm wide, and at midsection with 43 secondary parallel veins in each half. *P. brevicornutus* has the syncarp 3.5–5.2 cm long, 3–4 cm in diameter; drupes 16–18.5 mm long, 2–2.5 mm wide, narrowly cylindric; style 3–4 mm long, lanceolate, less commonly unevenly bifid; endocarp apex truncate; seeds 3–4 mm long; leaves 24–29 mm wide, and at midsection with 18–21 secondary parallel veins in each half.

The new epithet is taken from the Latin words *brevis*, short; *cornutus*, horned, and is chosen in reference to the short, hornlike style of this species.

Pandanus distentus sp. nov. (sect. *Rykia*)

Fig. 165

DIAGNOSIS HOLOTYPI: Planta cum foliis 1.8–3 m longis 9 cm latis crassiter coriaceis 1-sulcatis 2-plicatis in sectione M-formatis in sectione mediali cum 61 nervis parallelis secundariis prominentibus in quoque medio nervis tertiis fortibus in dimidia ultima reticulam formantibus lamina ligulata valde contracta in

apice 29 cm longo subulato caudato trigono eo 10 cm ex apice 1 mm lato basi non conservati, proxima basem marginibus cum spinis 5–7 mm longis 11–24 mm separatis deltoideo-subulatis complanatis subarcuato-adscendentibus pallidis sed apicibus nigris, midnervo infra cum spinis teretibus 5–6 mm longis 12–30 mm distantibus subulatis arcuatis reflexis nigris basibus crassis, in sectione mediali marginibus cum spinis 4–5.5 mm longis crasse subulatis arcuatis adscendentibus saepe tota pallidis, midnervo infra cum spinis 4 mm longis 4.5–6 cm separatis crasse subulatis arcuatis complanatis valde reflexis, in sectione diminuenti marginibus cum subulato-serris 1.2–2 mm longis 1–4 mm separatis arcuatis, midnervo infra angusto salienti cum aculeis simulantibus, in apice caudato marginibus et midnervo infra cum serrulis 0.2–0.4 mm longis 1–4 mm separatis, inflorescentia foeminea "circa 30 cm longa," pedunculo 10 mm diametro trigono folioso-bracteato probabaliter cum syncarpio solitario, syncarpio circa 15 cm longo et 10–11 cm diametro ellipsoideo, drupis multis 34–36 mm longis (vel stylo sequi 37–41 mm) 8–12 mm latis 7–12 mm crassis anguste oblanceoloideis subcompressis 5–7-angulosis corpore 30–32 mm longo anguste ellipsoideo vel filiformi lateribus subcurvatis vel planis, pileo 9–12 mm longo basi pyramidali-semiorbiculari laevi, stylo 3–5 mm longo osseoso rigido lucido compresso proxime curvato basi late oblonga parte supera acute bifida cum lobis subulatis sed eis cum lateribus exterioribus extensis undulatis, stigmatibus 3–4 mm longo late ovoideo bifido ad apices extenso brunneo papilloso, endocarpio submediali osseoso obscure brunneo lateribus 1 mm crassis intus lucido in apice cum projectione centrali anguste conico, semine 15 mm longo 5 mm diametro ellipsoideo obtuso, mesocarpio apicali cavernoso cum fibris et membranis, mesocarpio basali in lateribus fibroso intra carnosum.

DIAGNOSIS OF HOLOTYPE: Stature not recorded; leaves 1.8–3 m long, 9 cm broad, thick coriaceous, 1-ribbed and 1-furrowed, 2-pleated, in section M-shaped, at midsection with 61 parallel secondary veins in each half, these rather prominent except at base, the tertiary cross veins strong, transverse, forming oblong meshes, these at least from the middle outwards giving

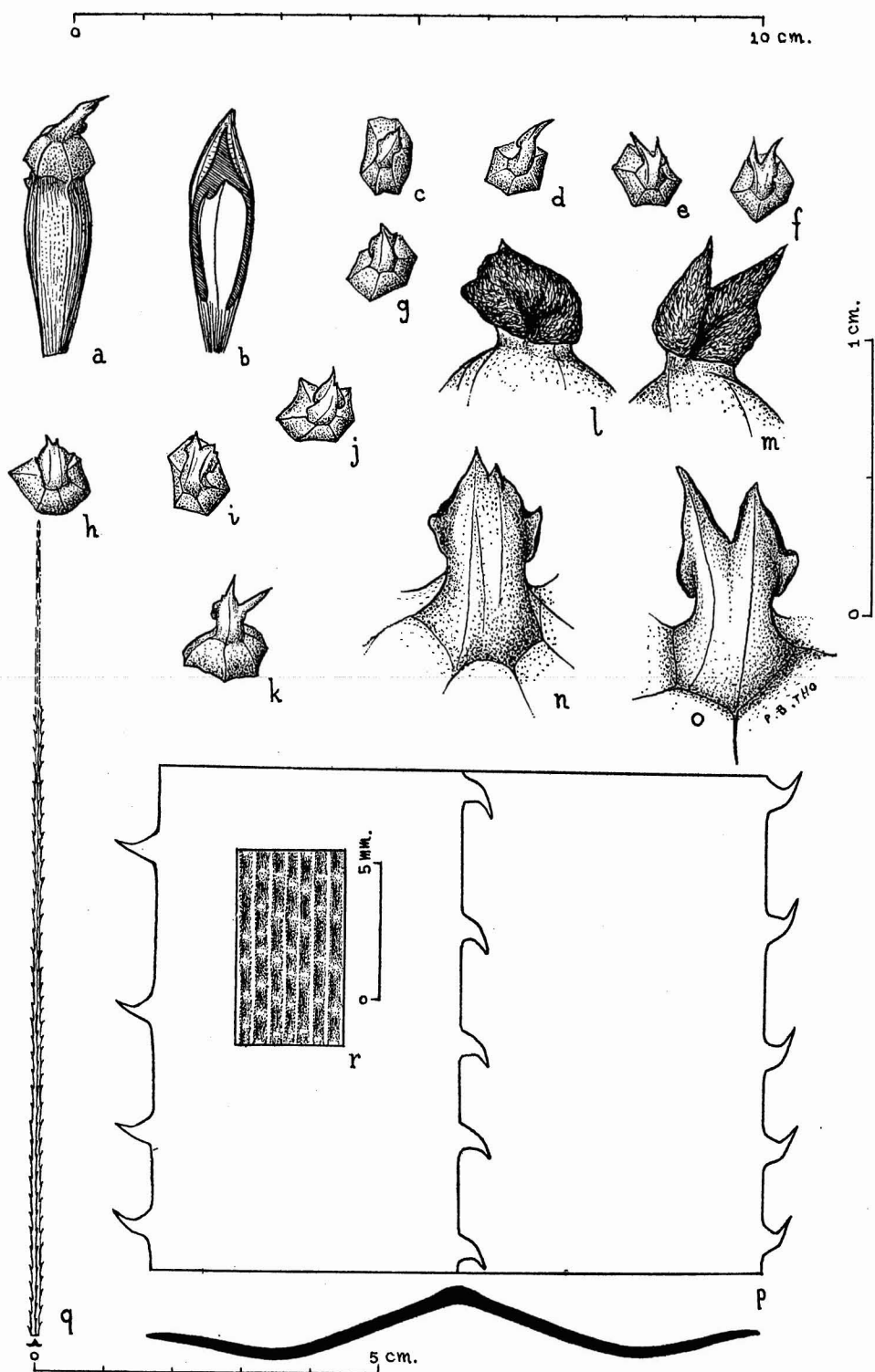


FIG. 165. *Pandanus distentus* St. John, from holotype. *a*, Phalange, lateral view, $\times 1$; *b*, phalange, longitudinal median section, $\times 1$; *c-k*, drupe and style, apical view, $\times 1$; *l, m*, stigma, proximal view, $\times 4$; *n, o*, style, distal view, $\times 4$; *p*, leaf base, lower side, $\times 1$; *q*, leaf apex, lower side, $\times 1$; *r*, leaf venation, lower side, near base, $\times 4$. (*e, f, h, i, k*, Frequent and most typical styles; *c, d, g, j*, infrequent forms of style.)

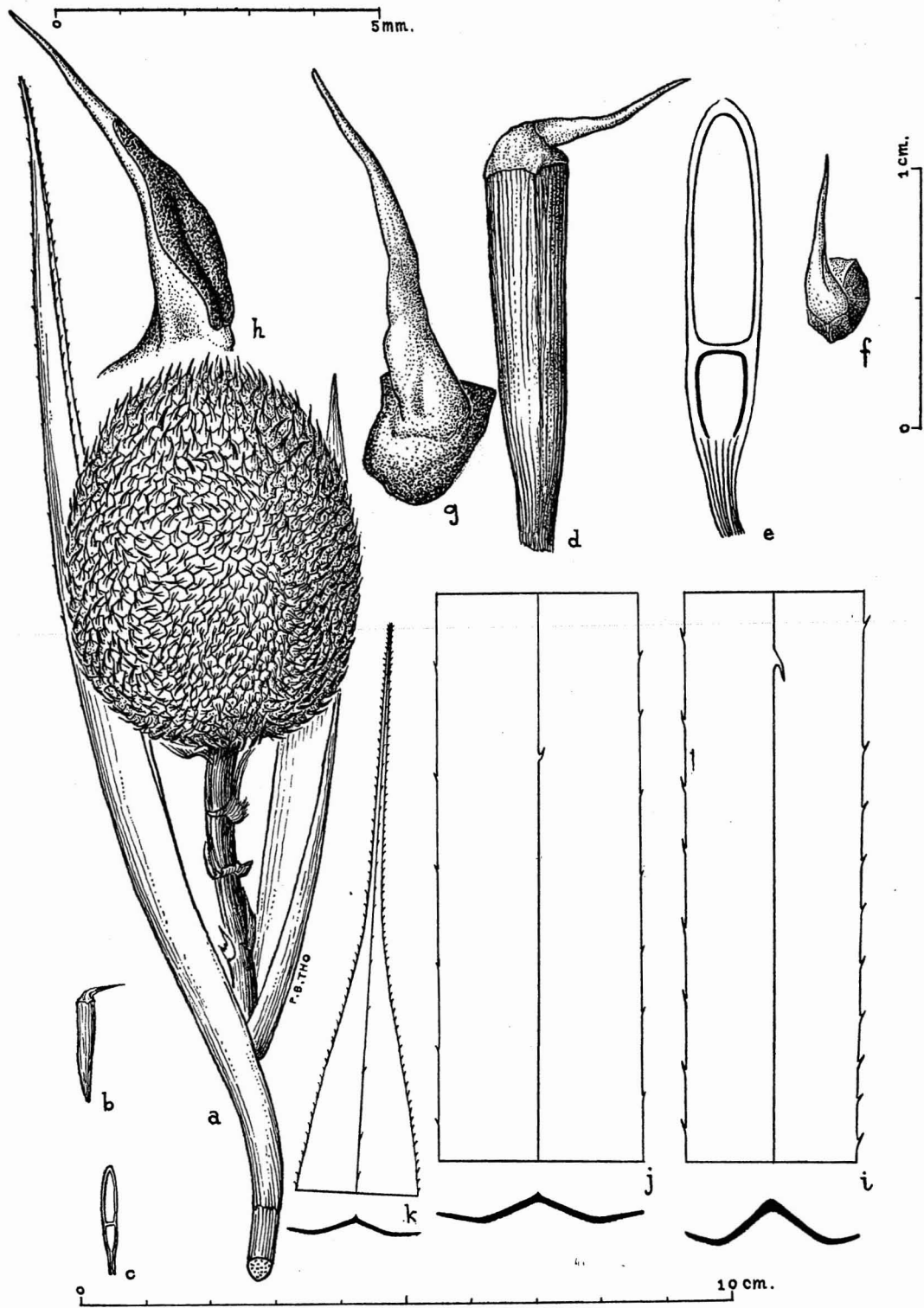


FIG. 166. *Pandanus inundatus* St. John, from holotype. *a*, Infructescence, habit, $\times 1$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, drupe, lateral view, $\times 4$; *e*, drupe, longitudinal median section, $\times 4$; *f*, drupe and style, apical view, $\times 4$; *g*, drupe apex and style, apical view, $\times 10$; *h*, style and stigma, proximal view, $\times 10$; *i*, leaf base, lower side, $\times 1$; *j*, leaf middle, lower side, $\times 1$; *k*, leaf apex, lower side, $\times 1$.

both leaf surfaces a reticulate appearance, the blade ligulate, rather sharply contracted to a 29 cm subulate, caudate, trigonous apex, this at 10 cm down from the tip 1 mm wide, the base not preserved, near the base the margins with thorns 5–7 mm long, 11–24 mm apart, deltoid, subulate, flat, slightly arcuate ascending, pale except for tiny blackish tips; the midrib below with heavy based, terete spines 5–6 mm long, 12–30 mm apart, subulate, arcuate, reflexed, black; at lower third the margins with spines 4–5.5 mm long, 13–29 mm apart, heavy subulate, arcuate, ascending, pale throughout or with minute blackish tips; the midrib with spines 4 mm long, 4.5–6 cm apart, flat, heavy subulate, arcuate, strongly reflexed; on the contracting area near the tip the margins with prickles 1.2–2 mm long, 1–4 mm apart, subulate-tipped serrae, arcuate; the midrib below narrow, sharp, salient, bearing similar prickles; on the caudate apex the margins and midrib below with serrulations 0.2–0.4 mm long, 1–4 mm apart; pistillate inflorescence "about 30 cm. long," peduncle about 10 mm in diameter, 3-sided, leafy bracted, apparently bearing a single syncarp, this apparently about 15 cm long and 10 or 11 cm in diameter, ellipsoid (an estimate based upon a part of the core, two slabs of drupes, and many separate ones); drupes numerous 34–36 mm long (or following the curve of the style 37–41 mm), 8–12 mm wide, 7–12 mm thick, narrowly oblanceoloid, a little compressed, 5–7-angled, the body 30–32 mm long, narrowly ellipsoid or fusiform, the sides gently curved or plane; pileus 9–12 mm long, the base pyramidal-semiorbicular, smooth; style 3–5 mm long, bony, rigid, shining, flattened, proximally curved, the base broad oblong, the upper part sharply bifid with subulate tips but the outer sides with broad, more or less undulate, expanded margins; stigma 3–4 mm long, broad ovoid, bifid, running to the apices, brown, papillose; endocarp submedian, bony, dark brown, the lateral walls 1 mm thick, the inner surface shining, with a narrow conical projection running upward into the beak; seed 15 mm long, 5 mm in diameter, ellipsoid, obtuse; apical mesocarp cavernous, but with fibers and membranes; basal mesocarp fibrous up the margins, fleshy within.

HOLOTYPE: Malaya, Pulau Penang, Telok Aling, native, common, 23 Oct. 1951, *J. Sinclair* 39,382 (SING).

DISCUSSION: *P. distentus* is a member of the section *Rykia*, as is its closest relative, the Malayan species *P. longicaudatus* Holtum & St. John, a species with the drupes 41–44 mm long, the lateral ones with styles 4–8 mm long, bifurcate, the forks subulate; endocarp walls 1.5–2 mm thick; leaves 4.7–6 cm wide, the caudate apex 15–22 cm long, secondary nerves 48 in each half, and near the base the margins with thorns 3–5 mm long, 6–14 mm apart. *P. distentus* has the drupes 37–41 mm long, the styles sharply bifid, but the lobes with undulate, expanded outer margins; endocarp walls 1 mm thick; leaves 9 cm wide, the caudate apex 29 cm long, the secondary nerves 61 in each half, and near the base the margins with thorns 5–7 mm long, 11–24 mm apart.

The new epithet is the Latin participle *distentus*, distended, and is given in reference to the lateral extensions of the style forks.

Pandanus inundatus sp. nov. (sect. *Rykia*)

Fig. 166

DIAGNOSIS HOLOTYPE: Frutex, caule in apice 8 mm diametro, foliis 37–42 cm longis 30–32 mm latis in medio sed proxima basem 20 mm latis chartaceis et sulcatis minime 2-plicatis ligulatis ad apicem diminuentibus in apice trigono subulato 4 cm longo 1–1.5 mm lato, in sectione mediali cum 19–20 nervis parallelis secundariis conspicuis in quoque dimidio, nervis tertialis nullis, basi amplexicauli et inermi sed ex 3–3.5 cm marginibus cum aculeis 2.5–3.5 mm longis 4–8 mm separatis subulatis arcuatis brunneis, midnervo infra ex 10 cm cum aculeis simulantibus 3 mm longis reflexis remotis paucis, in sectione mediali marginibus cum aculeis 0.8–1 mm longis 7–20 mm separatis subulatis adpresse adscendentibus, midnervo infra cum aculeo unico vel pluribus remotis 1.5 mm longis compressis arcuatis adscendentibus, in apice subulato marginibus et midnervo infra cum aculeis 0.3–0.5 mm longis 0.5–1.5 mm separatis subulatis adscendentibus, infructescentia terminali cum capite unico, pedunculo 12 cm longo 4 mm diametro trigono folioso-bracteato, syncarpio 6 cm longo 4.5 cm diametro ellipsoideo sed minime

3-planato cum circa 832 drupis eis 17–19 mm longis 2–2.5 mm latis 1.5–2 mm crassis viridibus corpore 14–15 mm longo anguste cylindrico compresso 5–6-anguloso, pileo 6–8 mm longo basi 2–2.5 mm alta ellipsoidea laevi, stylo 5–6 mm longo plerumque proximo frequente subreflexo, stigmatibus 2–3.5 mm longo anguste elliptico brunneo papilloso ex apice distante, endocarpio in parte $\frac{1}{3}$ infera cartilagineo pallide brunneo lateribus 0.1 mm crasso intra excludo, semine 2.7 mm longo ellipsoideo, mesocarpio apicali cavernoso 8 mm longo, mesocarpio basali in lateribus fibroso intra carnosio.

DESCRIPTION OF ALL SPECIMENS EXAMINED: Shrub up to 1.7 m tall, 8–15 mm in diameter, often decumbent; bark dark mahogany-colored, shining; internodes 7–11 mm long; prop roots several and as much as 40 cm long, 7–8 mm in diameter, brown, with loose spirals of adventitious rootlets 2–5 mm long, divergent, prickly-like; leaves 37–65 cm long, 25–34 mm wide at the middle, 20–24 mm wide near the base, chartaceous, above glossy dark green, below yellowish green, at base channeled above the midrib, slightly 2-pleated, ligulate, the apex narrowed to a 4–5 cm trigonous subulate tip 1–1.5 mm wide, at midsection with 18–22 secondary parallel conspicuous veins in each half, but no clearly visible tertiary veins, the base amplexicaul, unarmed, but beginning at 3–3.5 cm the margins with prickles 2.5–3.5 mm long, 4–8 mm apart, subulate, bent upwards, brownish; the midrib below beginning at 10 cm with a few remote similar prickles 3 mm long, reflexed; at midsection the margins with prickles 0.8–1 mm long, 7–20 mm apart, subulate, appressed ascending; the midrib below with one or several remote prickles 1.5 mm long, compressed, heavy based, arcuate ascending; on the subulate tip the margins and midrib beneath with prickles 0.3–0.5 mm long, 0.5–1.5 mm apart, subulate, ascending; infructescence terminal, with a single head, or rarely two heads; peduncle 10–17 cm long, 4–6 mm in diameter, trigonous, leafy bracted, sometimes pendent; syncarp 4–6 cm long, 3–4.5 cm in diameter, ellipsoid but slightly 3-sided, bearing 832–1,040 drupes, these 17–19 mm long, 2–2.5 mm wide, 1.5–2 mm thick, green, the body 14–15 mm long, narrowly cylindrical, compressed, 5–6-angled; pileus 6–8 mm

long, the base 2–2.5 mm high, ellipsoid, smooth; style 5–6 mm long, mostly proximal in attachment, often somewhat reflexed; stigma 2–3.5 mm long, narrowly elliptic, brown, papillose, remote from the apex; endocarp in lower $\frac{1}{3}$, cartilaginous, pale brown, the walls 0.1 mm thick, the inner surface dull; seed 2.7 mm long, ellipsoid; apical mesocarp a cavern 8 mm long; basal mesocarp fibrous up the sides, fleshy within.

HOLOTYPE: Malaya, Johore, Sungei Sedili, 30 July 1939, *Kiah bin Haji Salleh* 63,926 (SING).

SPECIMENS EXAMINED: Malaya, Johore, 5½ miles, Kota Tinggi-Mawai Road, in very swampy places in backwaters of streams, forming more or less pure stands, 13 April 1935, *E. J. H. Corner* 29,237 (BO, SING); Johore [Sungei] Berassau, Mawai-Jemaluang Road, frequent in swampy forest, 6 Feb. 1935, *E. J. H. Corner* 28,744 (SING); ditto, flopping, gregarious in wet hollows in swampy forest, 7 Feb. 1935, *Corner* s. n. (SING); ditto, gregarious in standing water, low elevation, 28 April 1935, *Corner* 29,361 (BO, SING); ditto, in standing swamp by the stream, 5 Jan. 1936, *Corner* 29,997 (SING).

DISCUSSION: *P. inundatus* is a member of the section *Rykia* and in that section is its closest relative, *P. Scortechinii* Martelli, a species with drupes 12–13 mm long; style terminal, 4–5 mm long; stigma linear; endocarp slightly submedian; seed 6 mm long; leaves 25–27 cm long, near the base 14 mm wide, at midsection the secondary nerves 15–16 in each half, tertiary cross veins visible in the outer half, at midsection the margins with weak prickles 0.2–0.3 mm long, flat appressed, close or remote or none. *P. inundatus* has the drupes 17–19 mm long; style of lateral drupes markedly lateral, 5–6 mm long; stigma narrowly elliptic; endocarp in lower $\frac{1}{3}$; seed 2.7 mm long; leaves 37–65 cm long, near the base 20 mm wide, at midsection the secondary nerves 18–22 in each half, no clearly visible cross veins; at midsection the margin with prickles 0.8–1 mm long, 7–20 mm apart, subulate, appressed ascending.

This was probably the species illustrated by Martelli (Webbia 4(2): t. 32, f. 1–3a, 1914) as his *P. johorensis* Martelli. Martelli did not have the habit of indicating the specimen from

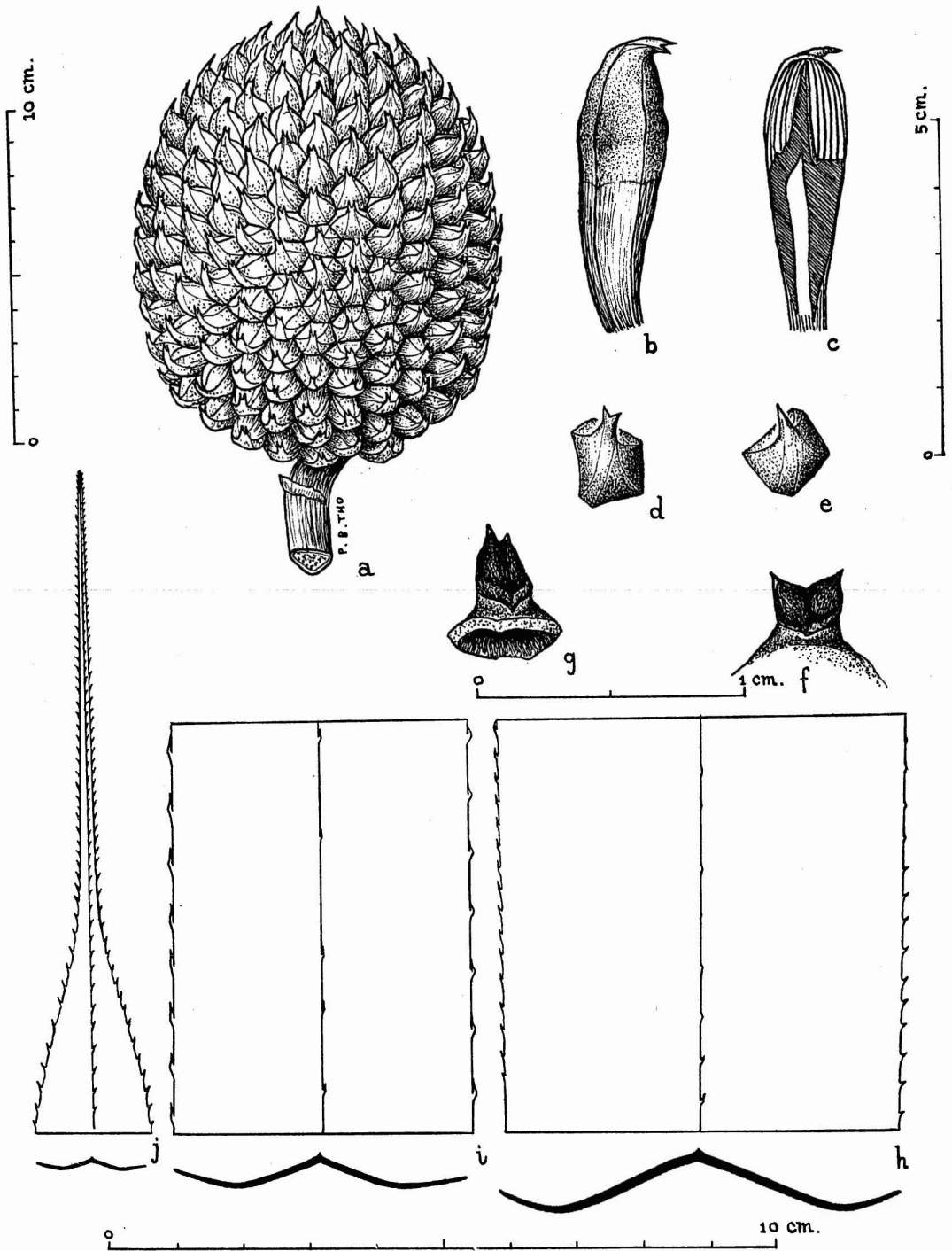


FIG. 167. *Pandanus kedabensis* St. John, from holotype. *a*, Syncarp, $\times \frac{1}{2}$; *b*, drupe, lateral view, $\times 1$; *c*, drupe, longitudinal median section, $\times 1$; *d*, lateral drupe and style, apical view, $\times 1$; *e*, apical drupe and style, apical view, $\times 1$; *f*, *g*, stigma, proximal view, $\times 4$; *h*, leaf base, lower side, $\times 1$; *i*, leaf middle, lower side, $\times 1$; *j*, leaf apex, lower side, $\times 1$.

which he made his illustrations. Evidence is now accumulating to show that he did not consistently illustrate the types, but rather that he used the best specimen at hand when making the drawing. Having seen and illustrated the type number of *P. johorensis*, it is evident to the writer that Martelli's figures on his plate 32, published 10 years after he published the species, were drawn from another specimen, not the holotype. This other specimen seems to be like those here described as the new species *P. inundatus*.

The new epithet is the Latin participle *inundatus*, flooded, given in reference to the habitat of the species.

Pandanus kedabensis sp. nov. (sect. *Rykia*)

Fig. 167

DIAGNOSIS HOLOTYPI: Planta cum "foliis grandibus," pedunculo 22 cm vel plus longo 12 mm diametro trigono folioso-bracteato, bracteis 47–70 cm longis 4.5–4.6 cm latis coriaceis 1-costatis 2-plicatis in sectione mediali cum 43 nervis parallelis secundariis in quoque latere eis supra evidentibus et infra prominentibus, nervis tertialis prominentibus et reticulum cum sectionibus oblongis formantibus lamina ligulata ad basem spathacea sed ex 14 cm marginibus et midnervo infra cum aculeis 0.5–1 mm longis 1–4 mm separatis subulatis adscendentibus apicibus brunneis, in sectione mediali marginibus cum aculeis 2–3 mm longis 2–10 mm separatis arcuatis subulatis adscendentibus adpressis semisombratis in margine undulato, midnervo infra angusto salienti cum aculeis 1 mm longis 1–4 cm separatis arcuatis subulatis adscendentibus, in apice caudato marginibus et midnervo infra cum subulato-serrulis 0.5–0.8 mm longis 1–2 mm separatis, syncarpio 12.5 cm longo 11 cm diametro late ovoideo cum circa 544 drupis eis 4.2–4.4 cm longis 8–13 mm latis 7–12 mm crassis anguste oblanceoloideis 5–6-angulatis parte $\frac{2}{5}$ supera libera corpore 3.8–4 cm longo, pileo 13–14 mm longo pyramidali-ovoideo 5–6-angulato laevi plerumque ex apice styli planato proxime inclinato truncato, stylo 4–5 mm longo oblongo osseoso brunneo lucido bifurcato lobis plerumque divergentibus, stigmatibus 2–3 mm longo proximo late ovato bifido brunneo papilloso paene in apicibus extento, endocarpio in

parte $\frac{2}{5}$ infera obscure brunneo osseoso cum projectione angusto pyramidali apicali lateribus 2–3 mm crassis intra rugosis lucidisque, semine 15–16 mm longo 2 mm diametro, mesocarpio apicali cavernoso et cum membranis albis, mesocarpio basali fibroso et carnosio.

DIAGNOSIS OF HOLOTYPE: Stature not recorded; "large leaved"; peduncle more than 22 cm long, 12 mm in diameter, 3-sided, leafy bracted, these bracteal leaves 47–70 cm long, 4.5–4.6 cm wide, coriaceous, 1-ribbed, 2-pleated, at midsection with 43 parallel secondary nerves in each half, these visible above, prominent below, the tertiary cross veins conspicuous, at right angles, forming meshes mostly oblong, the blade ligulate, towards the base spathaceous enlarged; at 14 cm above the base the margins and midrib below with prickles 0.5–1 mm long, 1–4 mm apart, subulate, ascending, brown-tipped; at midsection the margins undulate and with partly countersunk prickles 2–3 mm long, 2–10 mm apart, arcuate subulate, flat appressed, ascending, brown-tipped; midrib below narrow, salient, with prickles 1 mm long, 1–4 cm apart, arcuate subulate, ascending; the caudate apex having the margins and midrib below with subulate tipped serrulations 0.5–0.8 mm long, 1–2 mm apart; syncarp 12.5 cm long, 11 cm in diameter, broadly ovoid, bearing about 544 drupes, these 4.2–4.4 cm long, 8–13 mm wide, 7–12 mm thick, narrowly oblanceoloid, 5–6-angled, upper $\frac{2}{5}$ free, the body 3.8–4 cm long; pileus 13–14 mm long, pyramidal-ovoid, 5–6-angled, smooth, mostly truncate by the flattened upper side of the sharply proximally bent style, this 4–5 mm long, oblong, bony, brown, shining, bifurcate, the lobes mostly diverging; stigma 2–3 mm long, proximal, broad ovate, bifid, brown, papillose, extending almost to the apices; endocarp in lower $\frac{2}{5}$, dark brown, bony, with a narrow pyramidal apical extension, the lateral walls 2–3 mm thick, in inner surface rugose, shining; seed 15–16 mm long, 2 mm in diameter; apical mesocarp one large cavern with white membranes; basal mesocarp fibrous and fleshy.

HOLOTYPE: Malaya, Kedah, Kedah Peak, in low forest, not far from summit, 3,500 ft. alt., 1 April 1925, R. E. Holttum 14,858 (SING).

DISCUSSION: *P. kedabensis* is a member of the section *Rykia*, as is its closest relative, the

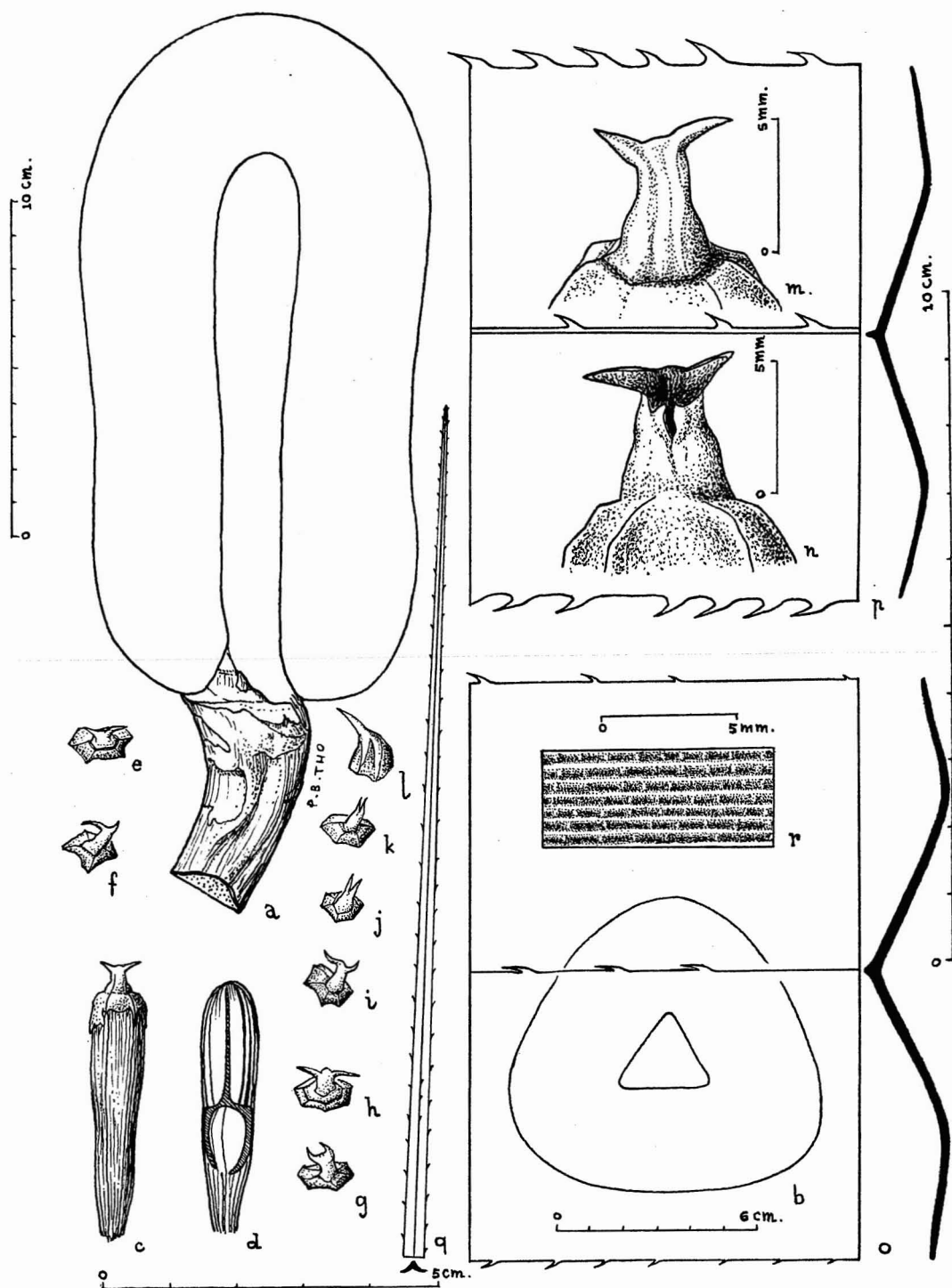


FIG. 168. *Pandanus serratus* St. John, from holotype. *a*, Syncarp profile, $\times \frac{1}{2}$; *b*, syncarp, outline of transverse section, $\times \frac{1}{2}$; *c*, drupe, distal view, $\times 1$; *d*, drupe, longitudinal median section, $\times 1$; *e-k*, lateral drupes and styles, apical view, $\times 1$; *l*, apical drupe, apical view, $\times 1$; *m*, carpel apex and style, distal view, $\times 4$; *n*, carpel apex, proximal view, $\times 4$; *o*, leaf base, lower side, $\times 1$; *p*, leaf middle, lower side, $\times 1$; *q*, leaf apex, lower side, $\times 1$; *r*, venation near leaf base, lower side, $\times 4$.



FIG. 169. *Pandanus albibracteatus* St. John, from holotype and paratype. *a*, Clump of pistillate holotypic trees at top of beach, with figure of Cheang Kok Choy; *b*, branch with syncarp; *c*, foliage of paratype, *St. John* 26,370; *d*, staminate paratype, *St. John* 26,370, with figure of Cheang Kok Choy.

Malayan species *P. longicaudatus* Holttum & St. John, a species with the peduncle 22 mm in diameter; syncarp 16–17 cm long, with about 900 drupes; pileus pyramidal-hemispheric; stigma 3–3.5 mm long; endocarp walls 1.5–2 mm thick, the inner surface smooth; and the seed 6 mm in diameter. *P. kedabensis* has the peduncle 12 mm in diameter; syncarp 12.5 cm long, with about 544 drupes; pileus pyramidal-ovoid; stigma 2–3 mm long; endocarp walls 2–3 mm thick, the inner surface rugose; and the seed 2 mm in diameter.

The new epithet is a Latinization of the name of the type locality.

Pandanus serratus sp. nov. (sect. *Rykia*)
Fig. 168

NOM. VERN.: "mengkuang ayer."

DIAGNOSIS HOLOTYPE: Licet aquatica in aqua vadosa, foliis 1.5 m longis in media 8.5 cm latis ad terminos ambos diminuentibus crassiter coriaceis supra viridibus infra minime pallidioribus 1-sulcatis 2-plicatis in sectione depresso M-formatis in sectione mediali cum 75 nervis parallelis secundariis in quaque dimidia in apice longe subulato diminuentibus basi amplexicauli inermi sed ex 20 cm marginibus cum aculeis 1–2 mm longis 5–10 mm distantibus valde

arcuato-subulatis pallidis adscendentibus, midnervo infra inermi, in sectione mediali marginibus cum spinis 6.5–7 mm longis 7–16 mm separatis fortiter arcuato-subulatis adscendentibus basi incrassata 4–5 mm lata apicibus rubris,

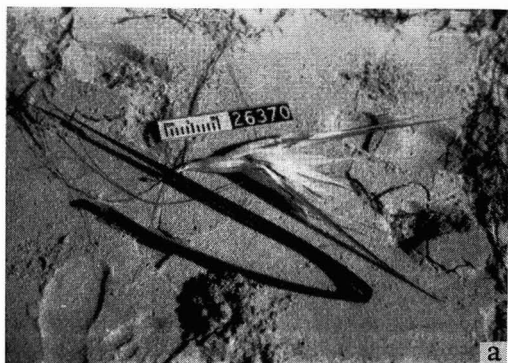


FIG. 170. *a*, Staminate inflorescence and leaf of *Pandanus albibracteatus*, paratypic specimen, St. John 26,370; *b*, *Pandanus ambiglaucus* St. John, holotype, branch, foliage, and syncarp; *c*, *Pandanus inclinatus* St. John, holotype, branch, foliage, and syncarp.

midnervo angusto salienti infra cum serris 2–2.5 mm longis 10–15 mm separatis adpresse adscendente subulatis, proxima apicem marginibus cum serrulis 0.5–1 mm longis 4–8 mm separatis, midnervo infra cum serrulis minutis remotis paucis; inflorescentia foeminea erecta cum 1 syncarpio, pedunculo 14 cm longo 1 cm diametro trigono bracteato, syncarpio 20.5 cm longo et proxima apicem 11 cm diametro, in media 9.5 cm diametro et basi subcylindrica, syncarpio 3-laterato apice obtuso cum circa 4,300 drupis eis 28–37 mm longis eis medialis basalisque 5–8 mm latis 4–6 mm crassis sed illis superis 9–12 mm latis 7–9 mm crassis oblanceoloideis, corpore 23–32 mm longo 5–6-angulato, pileo 4–8 mm longo basi semiorbiculari-pyramidalis laevi, stylo 3–5 mm longo osseoso brunneo lucido eis lateralibus et inferioribus 2.5–4 mm latis oblongis in basi latioribus gradatim proxime curvatis apice bifurcato lobis 1–3 mm longis plerumque divergentibus eis terminalibus cum stylo corniformi integro, stigmatibus 3–4 mm longis lanceolatis in lobis sed infra connatis brunneis papillosis proximis olim ad apices continuentibus, endocarpio in parte $\frac{1}{3}$ infera osseoso obscure mahogany-colorato lateribus 1 mm crassis pagina interiori lucida apice cum extensioni subulato centrali, semine 1 cm longo anguste obovoideo, mesocarpio apicali cavernoso 17 mm longo fibris marginalibus multis centralibus paucis et cum medulla, mesocarpio basali fibroso et carnoso.

DIAGNOSIS OF HOLOTYPE: Apparently aquatic, rooting in shallow fresh water; leaves about 1.5 m long, at the middle 8.5 cm wide, tapering towards both ends, thick coriaceous, green above, slightly paler below, 1-ribbed, 2-pleated, in section low M-shaped, at midsection with 75 secondary parallel veins in each half, tapering towards the tip into a long subulate apex, but the actual tip not preserved, the base amplexicaul and unarmed, but the margins beginning at 20 cm up with prickles 1–2 mm long, 5–10 mm apart, stout arcuate subulate, pale, ascending; the nearby midrib below unarmed; at midsection the margins with spines 6.5–7 mm long, 7–16 mm apart, heavy, arcuate subulate, ascending, the base much thickened, 4–5 mm wide, the tips reddish; the midrib below with appressed ascending subulate tipped serrae 2–2.5

mm long, 10–15 mm apart, on the narrow salient midrib; near the apex the margins with serrulations 0.5–1 mm long, 4–8 mm apart; the midrib below with a few, tiny, very remote serrulations; pistillate inflorescence erect, bearing

1 syncarp; peduncle 14 cm long, 1 cm in diameter, 3-sided, bracteate; syncarp 20.5 cm long, 11 cm in diameter near the tip, 9.5 cm at the middle, and near the base subcylindric, 3-sided, the apex obtuse, bearing about 4,300 drupes,



FIG. 171. *Pandanus incrassatus* St. John, holotype, *St. John* 26,374. *a*, Habit, foliage, and syncarp, with figure (right) of Paul Weissich; *b*, trunk; *c*, trunk and prop roots; *d*, branch, foliage, and syncarp.

these 28–37 mm long, the middle and lower ones 5–8 mm wide, 4–6 mm thick; the upper and apical ones 9–12 mm wide, 7–9 mm thick, oblanceoloid; the body 23–32 mm long, 5–6-angled; pileus 4–8 mm long, the base semi-orbicular-pyramidal, smooth; style 3–5 mm long, bony, brown, shining, of the lateral and lower ones 2.5–4 mm wide, oblong, broadening at base, gently proximally curved and at apex bifurcate, the lobes 1–3 mm long, mostly divergent, but the terminal drupes with simple, horn-like style; stigmas 3–4 mm long, lanceolate on the lobes but united below, brown, papillose, proximal, running almost to the point of the style; endocarp centering in lower $\frac{1}{3}$, bony, dark mahogany-colored, the walls 1 mm thick, the inner surface shining, the apex with a central, subulate prolongation; seed 1 cm long, narrowly obovoid; apical mesocarp a cavern 17 mm long, with fibers up the margin and a few within, and with traces of a medullary pith; basal mesocarp fibrous and fleshy.

HOLOTYPE: Malaya, Pahang, S[ungei] Bera,

w. Tasek Bera, low elevation, 15 Oct. 1930, M. R. Henderson 24,137 (SING).

DISCUSSION: *P. serratus* is a member of the section *Rykia*, as is its closest relative, *P. heterostigma* (Martelli) Martelli, a Sumatran species that has a raceme with 7–10 heads; syncarps 12–15 cm long, 9–19 cm in diameter; drupes 25 mm long, 7–8 mm wide; style spiniform, subulate, or narrowly oblong and bifurcate; and the leaves 2 m or more in length, 10 cm wide. *P. serratus* has the syncarp solitary, 20.5 cm long, 11 cm in diameter; drupes 28–37 mm long, 5–12 mm wide; style normally oblong, bifurcate but the apical ones stout, hornlike; and the leaves about 1.5 m long, 8.5 cm wide.

As is the case with many members of the section *Microstigma*, this species has the drupes near the apex of the syncarp markedly longer and wider than those of the lower parts of the syncarp.

The new epithet is the Latin adjective *serratus*, saw-toothed, given in reference to the leaf margins.